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ARCHEOLOGY.—*A survey of new archeological sites in central Pataz, Peru.*[1]

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TOPOGRAPHICAL SETTING

The province of Pataz (see map, Fig. 1), located at the eastern edge of the Peruvian highlands, enjoys an isolation that is uncommon even in rural Peru. Not only is it too far east to be in the orbit of the ancient north-south route through Huamachuco, Cajabamba, and Cajamarca, but its own terrain has prevented its extensive use as a jumping-off place for one of the several trails from the highlands into the eastern jungle. Aside from pure distance from the centers of population in the highlands, like Huamachuco, Pataz is also cut off from the main body of the mountains by the cañon of the Marañon River, which forms a barrier from south to north. Pataz is simply the western slope of the final eastern range of the Andes. From the Marañon, flowing at an altitude of 1,300 meters in the Pataz region, to the top of the eastern *cordillera* at more than 4,000 meters the distance as the crow flies is only 14 km at some points and nowhere more than 25 km. The Marañon and the crest of the eastern *cordillera* form the western and eastern boundaries of the province. This gives the whole province the effect of being turned up at an angle of about 20°, but this slope is not uniform. The valley of the Marañon was once a pleasant saucer-shaped valley with the river flowing on hard rock strata at about 2,500 meters. Once these strata were worn through, the river cut through the softer material leaving a cañon with extremely steep sides falling off more than 1,000 meters from the original valley floor.

The difficulties in crossing the Marañon, even by mule, have retarded the economic development of Pataz, but in recent years two mining centers have grown up at Retamas and La Paccha. Until now the mines have been supplied by mule trains from across the Marañon and by air to a small landing strip at the southeast end of the Laguna de Pías. A highway from Huamachuco to Chagual on the Marañon and from there to Tayadamba, passing through the mining centers has been under construction for some years and may be finished by 1951.

In addition to the inaccessibility of the region from the central highlands, the eastern tributaries of the Marañon have cut the province transversely, at some points to the depth of the Marañon itself. In central Pataz there are two such barriers. One of these is the valley formed by the Parcoy River, the Laguna de Pías, and the Alpamarca River. The second is the river valley formed by the Rio de la Playa rising near Buldibuyo and the Rio de Cajas rising near Tayabamba. These join at Huaylillas to form the Rio de Nahuinbamba flowing into the Marañon at Puente Jocos. These two deep valleys effectively separate the central massif and the high *puna* lying between Chilia, Parcoy, and Buldibuyo from the regions centering around Tayabamba to the south and the town of Pataz to the north.

[1] This report summarizes the architectural findings of an expedition to Pataz during a part of the months of July and August, 1949, sponsored by the Institute of Anthropology of the National University of Trujillo, Peru. The personnel included the author, Luis Gutiérrez, John Ladd, Mrs. Helen P. Ladd, and Mrs. Phyllis Curtin, all of whom contributed to the preparation of this report. The author is indebted to Richard Schaedel, the director of the Institute of Anthropology, and to Drs. José Eulogio Garrido and Manuel Zavaleta C., of Trujillo, for their assistance in the field. He also wishes to express appreciation for consultations with Drs. A. Kidder, II, and Wendell C. Bennett. Sr. Gutiérrez is preparing a report on the ceramic and skeletal materials from Pataz, which will appear elsewhere.

The expedition in 1949 confined itself to a survey of the archeological remains in the central area, that is, to the area between the Nahuinbamba on the south and the Parcoy on the north. This forms a small natural geographical region centering around

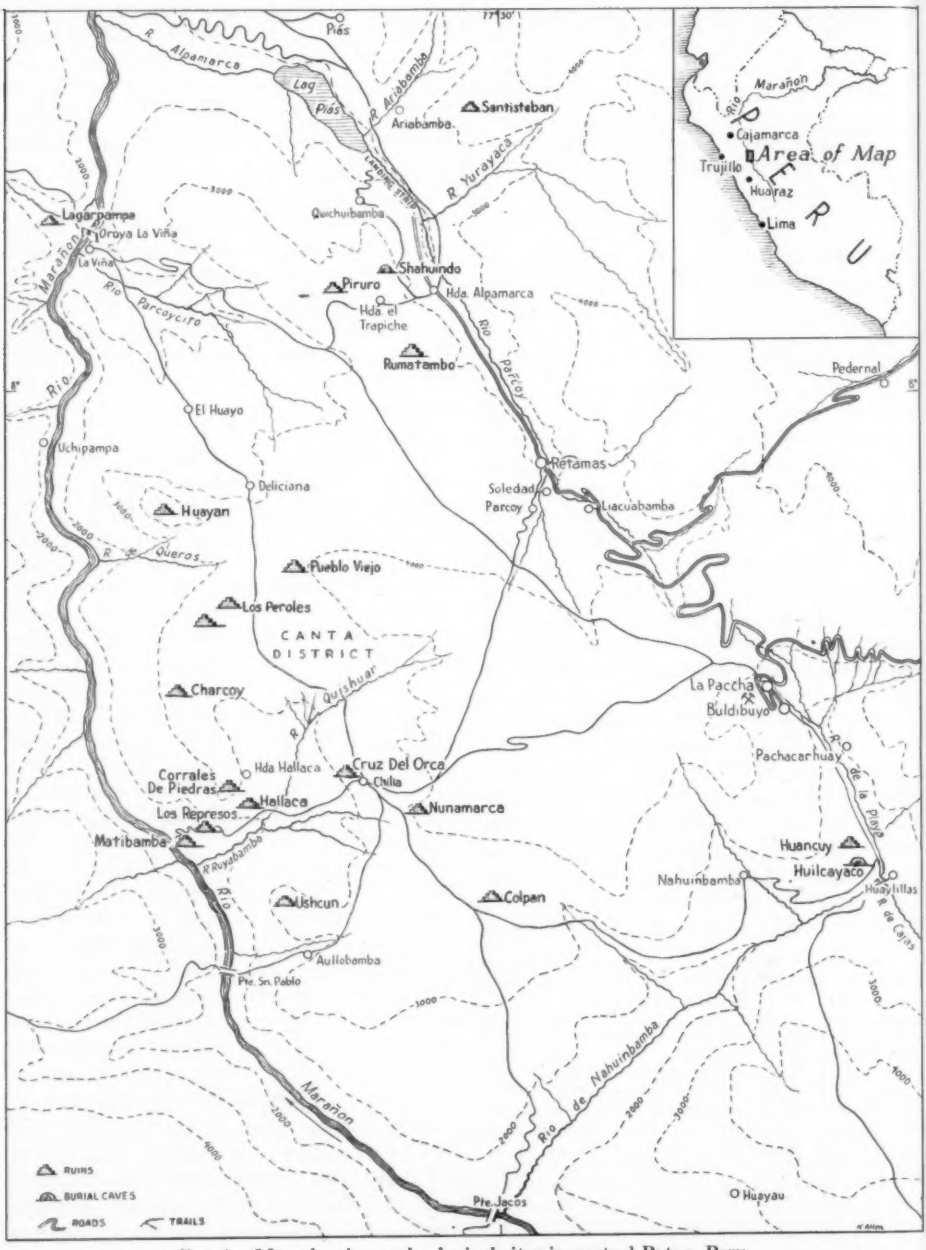

FIG. 1.—Map showing archeological sites in central Pataz, Peru.

the town of Chilia and its rich valley. Although this region is not large, there are enormous climatic variations. In the high *puna* within the triangle Chilia-Parcoy-Buldibuyo the cold high grasslands are used principally for sheep raising. Lower down transportation animals are grazed. Still lower in the valleys of Chilia, of the Parcoy, the de la Playa, the Parcoycito, and the Queros the normal Andean crops of maize, wheat, potatoes, and alfalfa are grown. In the cañon of the Marañon there are no crops below the altitude of 2,500 meters because of extreme aridity. Only desert vegetation is found from that altitude to the bottom of the cañon. Along the banks of the river itself small areas are irrigated and planted in coffee, oranges, mangoes, and bananas. Surplus agricultural products are mainly sold to the two mining centers at Retamas and La Paccha, but a small amount is also exported across the Marañon.

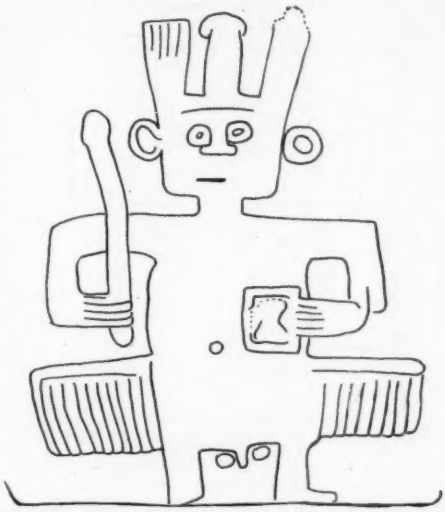

FIG. 3.—Warrior figure 86 cm high from stone relief slab, Chilia village.

CHILIA

The present village of Chilia, at 3,170 meters in the center of the arable area, was not an ancient habitation site. It was formed, according to local legend, under the Viceroy Toledo in the late sixteenth century from the two older villages of Chilia and Charcoy located on opposite sides of the valley. The tradition of the two separate villages is still strong and has a part in many local rivalries. Nevertheless, the *patasinos* generally have forgotten Quechua and any precedent languages and speak only Spanish. Casual observation seems to indicate that the population is almost entirely mestizo.

In spite of its relatively recent origin, Chilia has come to have more stone sculpture than any site found in Pataz. The ancient citadel of Nunamarca is close to the village and has supplied almost all of the building stone used in its construction. The inhabitants have also gathered a number of stone slabs carved in relief. These are kept as decorative pieces for door sills or for decoration within the houses. Twenty-four pieces were examined, though there are surely many more in the vicinity.[2] These fell into moderately well-defined motif catagories. Of the 24 examples, eight had designs depicting felines. These are carved in relief 5 to 10 mm high on one side of stone slabs about 20 cm wide by 50 cm long and 10 cm thick (Fig. 2). These figures showed no particular orientation of the head to the right or the left of the slab, but all faces were shown full-face and had a strong tendency toward anthropomorphic features. All tails were curved upward. The number of toes shown on the feet varied from one to four, with several examples having two very birdlike toes. In addition to the eight slabs showing a single

FIG. 2.—Stone relief slab with feline motif, Chilia Village.

[2] The National Museum at Pueblo Libre has a collection of stone sculpture from Chilia and Nunamarca made by Dr. Julio Tello in the late thirties. Unfortunately, Dr. Tello did not publish a report on this expedition before his death, and the National Museum does not indicate the exact provenance of these exhibits. In addition to the sculpture types found in 1949, this exhibit includes head-tenons from the Chilia area.

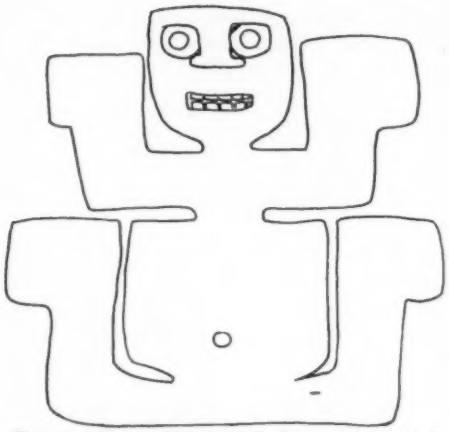

FIG. 4.—Figure 35 cm high from stone relief slab, Chilia Village.

feline, two slabs showed two feline figures. One of these had two typical felines with their heads together at the center of the slab. The other was similar, except that the two felines shared a single head, having one body on either side.

Next to the feline, the most common figure on relief slabs was a warrior figure, occurring on five slabs of the 24. Typically this is a full-length figure of a man holding a club in one hand and a trophy head in the other. The only clothing commonly shown is a 3-element crown on the head, ear plugs, and an ornament resembling wings projecting on either side of the body from the hips. Genitals are often shown (Fig. 3).

Third in frequency of occurrence is a full-face anthropomorphic figure with both arms and legs in the air, occurring in four of the 24 examples. The arms are shown straight out from the shoulders and then upward at a right angle from the elbow (Fig. 4). The legs are bent outward from the hips and upward from the knees The only clothing shown on this type of figure is a three-element crown worn by two of the four examples.

The remaining stone sculpture is not clearly classifiable by groups. Three of the five remaining designs were geometric in character (Fig. 5) and showed no recognizable naturalistic motif. Of the remaining two, one showed a monkey in sitting position (Fig. 6). The other was a human head in the round, very roughly carved in the natural rock about 26 cm high and 13 cm in diameter.

NUNAMARCA

Closely associated with Chilia village there are two archaeological sites. The more important of these is Nunamarca, the largest site discovered in Chilia Valley. It is located at the top of a rocky promontory jutting into the center of Chilia Valley at an altitude of about 3,500 meters, or 300 meters higher than Chilia itself (Fig. 7, *b*). These ruins can be reached from Chilia by following the mule trail toward Buldibuyo for about 4 km and then turning off sharply to the right at the farm of Augusto Dominguez. This house roughly marks the northern limits of the site. To the south and west the site is bounded by the steep sides of the bluff.

At present Nunamarca is in a very bad state of preservation. It has been cultivated for some generations as well as being used as a quarry for building stones over the last several hundred years. Few of the former walls can be traced, but large numbers of cut stones are now piled up or built into walls to clear them from the fields. The remains of walls and building stones, however, still cover an area about 500 meters in length by 200 meters in width, an area considerably larger than the present village of Chilia. At the southern border of the site area, overlooking the bluff and cliffs, there is an extensive retaining wall about 150 meters in length and 10 meters to 12 meters in height, the total height being broken by a terrace about 1 meter wide some 5 meters from the top of the wall. This wall is con-

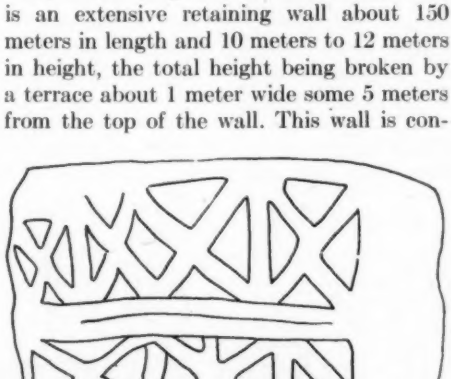

FIG. 5.—Latticelike design in low relief on slab 67 by 47 cm, Chilia Village.

structed of rows of faced stones 30 cm or more in height broken by alternate rows of stones no more than 5 cm in height. An adobe mortar was used and the rows are somewhat irregular. Toward the eastern end of this wall about 2.5 meters from the top there is the entrance to a gallery about 1 meter square faced with stone and covered with a single stone lintel at the opening. According to local informants this was formerly open for some distance under the site, but a second shaftlike entrance at the top of the ruin was filled a few years ago. The dirt from this fill now blocks the gallery a meter or so beyond the entrance.

Although the sculptured stones in Chilia village originally came from Nunamarca, only one piece of sculptured stone was found at the site itself. This was a slab about 60 cm in diameter, having a design of six concentric semicircles cut into it to the depth of about 1.5 cm. The entire site area was rich in potsherds on the surface.

CERRO DE LA CRUZ DEL ORCA

The second site associated with Chilia village is Cerro de la Cruz del Orca, located about 1 kilometer to the west of Chilia on the ridge slightly below the village. It can be reached by trail on foot in a few minutes. At present the visible remains are undistinguished, being nothing but a single platform constructed on a small point of land. This platform is 10 meters to 15 meters in diameter and is supported by a stone retaining wall about 5 meters in height, now largely fallen down. A great deal of ceramic material was found on and around the platform and at places where the sides were badly eroded sherds were found in the earth and rubble fill of the platform at a depth of about 2 meters. The people who farm the site area informed the author that there is a cave nearby which is associated with the ancient inhabitants and is now inhabited by evil spirits.

THE CANTA DISTRICT

In the Canta district of Chilia three prehistoric habitation sites were examined. For lack of definite local names, these have been called Canta I, II, and III. All three are located within a few hundred meters of the easterly of two mule trails from Chilia toward Hacienda "Deliciana." Canta I is about 5 km from the village, while Canta II and Canta III are about 2 km farther along.

FIG. 6.—Monkey figure 18 cm high from relief slab, Chilia village.

From the distance Canta I appears to be a low hilltop covered with brush. Beneath the underbrush and extending down into the cultivated area below there are three large concentric terrace levels, varying in width from 15 to 40 meters and following the conformation of the hill. In the middle of the highest terrace level there are remains of a truncated pyramid rising in small steps and faced with stone. The site area, especially the upper levels where walls have not been disturbed by cultivation, is covered with houses and the remains of walls in varying states of preservation. Two principal types of wall construction were observed. The most common, especially for retaining walls, was ordinary *pirca* using stones of medium and uniform size and faced on the outside. A more elaborate form makes use of alternating rows of thick and thin stones, similar to the type described in connection with Nunamarca. Because of the heavy cover of vegetation it is impossible to estimate accurately the number of house outlines, but the extent of the site area now covered with stone work indicates that it was once occupied by a moderately large population. Clearing and excavation would be necessary to show the ground plan and the true extent of the site.

Canta II also consists of a series of concentric circular terraces around a natural hilltop about 60 meters in height. It is much smaller than Canta I, the lowest terrace level being only about 300 meters in diameter. The retaining walls of the terraces are of ordinary uniform *pirca* faced on the outside only, but a large number of completely finished rectangular building stones were observed on the various levels, presumably the remains of structures that have since been torn down to provide stones for more recent building. The only remaining structures on the terrace levels were circular walls 3 to 4 meters in diameter and about 1 meter in height. These are the outlines of the house type most commonly found in Central Pataz. Canta III is a slightly smaller version of Canta II, occupying another hilltop on the same ridge.

PUEBLO VIEJO SOBRE PARCOYCITO

On the ridgetop dividing Chilia drainage from the Parcoycito and Queros valleys there is a succession of habitation sites, fortresses, and pyramids. Seven of these sites were examined in 1949. The highest and most easterly is Pueblo Viejo, located at an altitude of about 3,800 meters on the ridge between the headwaters of the Rio Quishuar and the Rio Parcoycito. It can be reached from Chilia by taking either of the northern mule trails toward La Viña, since these trails rejoin in order to cross the pass into the valley of the Parcoycito. At this pass, about 15 km from Chilia by either trail, a rough path can be seen branching off to the eastward and following the height of land up the ridge. This trail passes through the site of Pueblo Viejo after a climb of about 3 km from the pass.

The site consists of a dwelling area on the high *puna* surrounded by defense works. As the ridge rises eastward from the pass the ascent is steep and unbroken until a small point of land is reached. From this point eastward for about 1 km the ridge ceases to climb and swings in a wide semicircular bow to the south. Within the bow to the north of the ridge and about 20 meters below it at its lowest point there is a relatively flat sheltered area measuring perhaps 400 by 200 meters and covered by the remains of the principal dwelling area. The point at the western limit of the site is terraced in the style of Canta II, and the ridge top is terraced and covered with house outlines of the round type met at Canta II as well as rectangular houses about 2 meters in width by 4 meters in length.

In the dwelling area itself there are two principal types of structure. The most common are circular enclosures about 20 to 30 meters in diameter having outside walls 1 to 2 meters in height (Fig. 7, *d*). Within these enclosures there are stone walls outlining smaller circular buildings 3 to 4 meters in diameters. These are irregularly placed, occasionally having part of a wall in common or partly depending on the wall of the larger enclosure, but in general there is a small court or plaza in the center. In all there are 10 to 14 enclosures of this type. The second type of structure in the dwelling area is a larger rectangular building with thick walls now 2 to 3 meters in height in some of the better preserved examples. The exact ground plan of these remains could not be discovered without removing the fallen rock and rubble that covers most of their location. It is also now impossible to tell whether this structure represents a group of buildings or a single large one.

To the north of the dwelling area and a little below it, there is a single wall running from east to west enclosing the area on the single side not enclosed by the ridge. This wall is about 800 meters in length and about 2 meters high. Eastward along the ridge about 1 km from the dwelling area there are further defense walls. These cross the ridge transversely, protecting the site from attack directed down the ridge from the heights (Fig. 8, *d*). From west to east this system contains three elements—a wall 1.5 meters high, a wall 4 meters high followed by a ditch 3 meters deep, and a wall 2 meters high followed by a ditch 2 meters deep. Unlike the northern defense wall nearer the dwelling area, the southeast walls are embankments perhaps 2 meters wide made of the earth piled up in the construction of the defense ditches or moats associated with them. The embankments are faced with a vertical retaining wall on the west side, away from the village. These walls are rough *pirca* faced on the outside. Of the three walls,

FIG. 7.—Architecture and views of central Pataz: *Upper left* (*a*), West wall, upper level of Los Peroles, showing cornice; *upper right* (*b*), Chilia Valley and Nunamarca (center) from the northwest; *lower left* (*c*), Piruro; *lower right* (*d*), portion of a round house-complex, Pueblo Viejo.

only the middle one extends for any distance down the sides of the ridge, in this case for about 1 km to the south.

Within the site proper three types of construction were observed. Some of the houses on the ridgetop are made of uncut, unfaced *pirca*. The round groups within the dwelling area are similar except for facing and more careful workmanship. The rectangular buildings within the dwelling area and the northern defense wall are constructed of large stones 30 cm or more in diameter interspersed with smaller flat stones. The large stones are not laid in regular courses, but placed evenly through the smaller construction. In spite of the similarity of this stone work to the alternate courses of large and small stones found at other sites, only the uncoursed type was found at Pueblo Viejo.

LOS PEROLES DE HUAMPO

Passing from the site of Pueblo Viejo sobre Parcoycito to the westward along the ridgetop, the next site is Los Peroles de Huampo. Los Peroles occupies a position to the west of the pass between Chilia and the valley of the Parcoycito corresponding to that of Pueblo Viejo to the east. Leaving the mule trail between Chilia and La Viña and following the ridgetop to the west the site is found at about 3,400 meters after a brief continuous ascent. Beyond Los Peroles the ridge drops again and splits into two branches. One fork swings to the southward around Chilia Valley, while the other forms the south watershed of the Parcoycito rising to the heights of Huayan. Between the two forks the Queros River drains a small valley and empties into the Marañon.

At Los Peroles the most important elements are two structures on the open summit of the ridge, a platform (structure I) and a pyramidal group of concentric terraces (structure II). In addition there are a number of defense works, house frames, and terraces. Approaching the site from the east along the ridge a defense ditch about 1 meter deep lies transversely across the ridge. From this point three sloping terraces partially covered with round house frames of the familiar type rise to structure I, the more easterly of the two. This is a square stone-faced platform about 7 meters high and 14 meters square. The sides of the square are oriented so that they face directly toward the four points of the compass, but this is not necessarily intentional, since the north and south sides are parallel to the line of the ridgetop. On the top of the square platform there are six round house outlines of the usual type. In addition, toward the northwest corner of the structure there is a vertical shaft about 1 meter square, the sides of which are lined with faced stone work. At present this is about 2 meters deep, but the bottom is loose earth and rubble indicating that it may have been deeper.

Structure II lies about 130 meters to the west of structure I. The two are separated by a dip in the ridgetop about 30 meters lower than the top of either. At the bottom of this dip a second transverse ditch about 2 meters deep crosses the ridge. Above the dip to the west structure II rises in a series of three wall-supported terraces. The three retaining walls are each about 7 meters high, giving the whole a uniformity with the 7-meter height of structure I. Since the lowest of the retaining walls rises from a terrace cut into the natural slope of the hill, there are four terrace levels in all. The three lower levels are concentric and elliptical being roughly accommodated to the shape of the ridge—the fourth and highest alone being nearly round. The whole structure measured at the lowest level is 95 meters in length by 25 meters in width. The terraces are not completely symmetrical. Since the eastern slope is less steep than the western, the terraced levels on that side average 16 meters in width, while the same levels to the west measure only 11 meters each. The three lower terraces are uniformly 3 meters in width toward the north and south, giving the structure its elliptical shape. The central round level is 13 meters in diameter. All the retaining walls are constructed of faced stone, roughly rectangular, coursed, and having alternate courses wider than the rest. About 50 cm below the top of the highest wall there is a cornice formed by one course of stones that projects about 10 cm from the wall (Fig. 7, *a*).

As with structure I, all the terrace levels show the remains of house circles varying

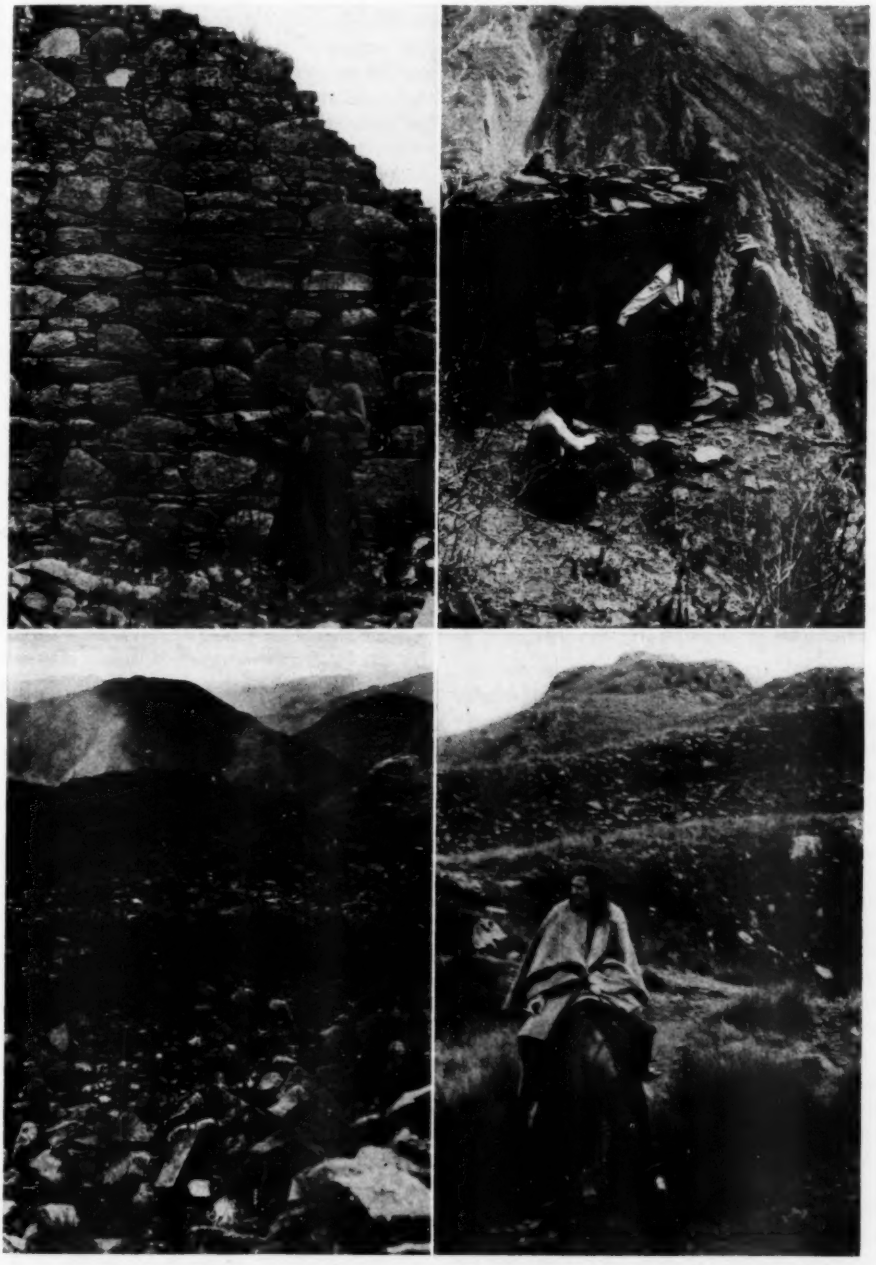

FIG. 8.—Architecture and views of central Pataz: *Upper left* (*a*), North wall of principal structure, Charcoy; *upper right* (*b*), west side, upper story, Matibamba *chulpa; lower left* (*c*), house remnants at Charcoy looking north, heights of Huayan in the distance; *lower right* (*d*), eastern faced earthworks and defense ditches at Pueblo Viejo.

in number from four on the highest level to about 14 on the lower levels. No rectangular house outlines were observed. In the middle of one of the house circles on the third terrace level there is a vertical shaft similar to that observed on structure I. At first this was taken for a treasure-seekers' hole, since it was not lined with stone. A closer examination, however, showed that it connects with the remains of a horizontal gallery entering the base of the retaining wall just above the second level.

Associated with these two principal structures there is a small village of round houses on the side of the ridge a few hundred meters to the southwest as well as a number of house circles on the ridge itself to the east and west of the site. In addition a large group of terraces and houses were observed farther to the west between Los Peroles and Charcoy, indicating that virtually the entire ridge top was once occupied. The center of this group is a terraced hilltop about 3 kilometers west of Los Peroles. There is no known local name for this site.

CHARCOY

Continuing along the crest of the ridge past this last site, the ridge drops steeply forming a pass. Through this pass there is a trail connecting Chilia village with the valley of Queros. Beyond the pass the ridge rises very steeply for about 3 km. There is no trail, but animals can travel fairly easily along the treeless summit, forcing riders to dismount only occasionally in especially steep or rocky slopes. Over this rise the ridge slowly bends to the south, until its direction is almost north and south. Charcoy occupies the highest point after the new ascent, being at about 3,700 meters, or almost as high as Pueblo Viejo and a good deal higher than Los Peroles. The site is clearly visible from Chilia village, since the higher walls stand out against the skyline.

The remains of Charcoy are very extensive, though many of the walls are now nothing but scattered pieces of cut stone (Fig. 8, *c*). Along 500 meters of the ridgetop, which is 500 to 100 meters wide and relatively flat at this point, there are about 60 houses in good condition. Of these around 80 percent are of the round type. The remainder are rectangular of the type found on the ridge at Pueblo Viejo. Some of the house circles are arranged within enclosures on a plan similar to that at Pueblo Viejo.

At the center of the ruined area the corner of one structure shows the most careful stone work observed in Pataz. The only remains of a larger building, however, are a corner and two side walls extending about 7 meters in one direction and 12 meters in the other. The longer of these two sides is oriented in a general north-south direction, but again this is the direction of the ridge. Inside this building there are the remains of two rooms, each about 1.3 meters square. These are side by side along the east wall with doorways opening toward the inside of the building toward the west. In this area the stone and rubble of fallen walls make it impossible to trace the ground plan without excavation. At one time the standing portion must have been part of a much larger building. Even at present the wall is higher than 5 meters at its highest point. The construction of inside and outside walls is identical. The walls are between 68.5 and 76 cm thick constructed of a red clay and rubble fill faced on both sides with cut rock in alternate courses of large and small stones (Fig. 8, *a*).

A cursory survey of the site revealed only three examples of decorated stone, but among many thousands of cut stones in the area there are probably a number of others. Two of these stones were slabs about 10 cm thick and 70 cm square bearing an incised rectilinear geometric design. They could have been either an individual decoration or a portion of a larger motif running along a number of facing slabs. The third decorated stone bore a single incised serpentine line having nine reverses of direction. This might represent a snake or be a merely decorative line.

CORRALES DE PIEDRAS

Six kilometers farther south along the same ridge from Charcoy is the site of Corrales de Piedras. This can be reached either by the ridgetop route, or by going directly from Chilia to Hacienda "Hallaca," where a guide can be secured to point out a more direct route up the ridge. The latter route is more difficult, but shorter.

Corrales de Piedras has a general appearance and location similar to Charcoy. It is also situated on the top of the ridge, and its principal features are a number of terraced hilltops and dwelling areas scattered along the ridge for about 1,500 meters. The area is larger than that of Charcoy, but settlement does not seem to have been as dense. Corrales de Piedras' altitude of 3,300 meters is also sufficiently lower than Charcoy to be out of the completely treeless area. Parts of the site are covered by thick underbrush, although this sort of vegetation does not normally grow so high. The site is clearly visible from Chilia village and is especially marked by the brush, the only vegetation other than grasses that appears on the skyline to the northeast.

Approaching Corrales de Piedras from the north, the first evidence of former habitation is a very elaborate system of defense walls and ditches constructed in the same manner as those to the east of Pueblo Viejo. The principal difference at Corrales de Piedras is the remains of a portal through one of the walls. Here there is an opening about 1 meter wide with an upright stone jamb about 50 cm in diameter and 1 meter high on either side. Immediately beyond the wall system is the first of two points of land terraces in the usual manner. Between these the brush covers a slight saddle in the ridge, obscuring the layout of a large number of partially ruined structures of faced *pirca*. Beyond the saddle the ridge rises again through a series of four well-preserved terraces to the second high point. The levelled top of this point, as well as the terraces and the hillsides to the east and west of the ridge show the remains of a number of round houses similar to those at Charcoy and Los Peroles. Beyond the second point the ridge slopes down rather steeply through a series of nine terraces to a very small platform about 5 meters in diameter. These terraces also have the remains of house circles. From the last platform the ridge slopes downward so abruptly that it is only passable by animals with the greatest difficulty. After about 2 km this slope breaks into an impassable series of cliffs, marking the end of the ridge to the south.

HALLACA

A small point of land just above the cliffs to the south of Corrales de Piedras is the site of a number of concentric stone faced terraces at about 3,000 meters altitude. This small point is so isolated on the steep hillside that the use of its terraces for purely agricultural purposes seems unlikely. It may have served as an outpost for Corrales de Piedras or as a small fortress to control traffic over one of the trails passing from the valley of Chilia to the Marañon. This trail now passes through a small natural gateway between the site and the main slope of the ridge. The site is clearly visible from the Hacienda "Hallaca" buildings which lie about 2 km to the northwest directly below Corrales de Piedras. Hallaca is reached from Chilia in two hours by mule by turning off the westerly trail to La Viña about 6 km from Chilia.

LOS REPRESOS

Los Represos is much lower in altitude than the ridgetop sites discussed above, but its general characteristics are the same. It is located at about 2,000 meters on a short ridge extending into the Marañon Valley between the Río de Ruyabamba on the south and the Marañon itself on the north and west. Los Represos is reached from Chilia in about four hours by mule over a good trail that follows the northern side of the Ruyabamba Cañon to the orchards of Matibamba at the bank of the Marañon. At the point where this trail crosses a ridge from the drainage of the Ruyabamba to that of the Marañon the site is seen on the trail itself and toward the west down the ridge.

The local name, Los Represos, comes from the site's distinctive feature. There are two depressions or plazas in the top of the ridge about 16 meters in diameter and lined with stone to the depth of about 1 meter. These are thought to be water reservoirs connected with an irrigation system for the Marañon Valley, especially for the site of Matibamba, which lies directly over the ridge to the north. They seem rather small to store any considerable quantity of water, and no other irrigation works were noticed in the area. At present there are no sources of water within 5 or 6 km of the site.

In addition to the two "represos", there are three other structures on the ridge. Two of these are single level square stone faced platforms about 3 meters in height. The third is a large rectangular platform a little more than 3 meters high with a square platform of the same height on the top, giving a pyramidal effect. All retaining and lining walls are of average uniform *pirca*. The double platform contains a large treasure-seekers' hole in the middle of the highest level. On the second level there was a small round low platform about 3 meters in diameter with a square shaft about 1½ meters in width in the center.

MATIBAMBA

Following the trail over the ridge and down into the Marañon to the north of Los Represos there are a series of hairpin turns leading to the cañon floor. Here, along the edge of the river at 1,320 meters, is the small settlement of Matibamba and an irrigated area in which tropical fruits are raised. Above the irrigated area for about 500 meters and extending along the valley for the same distance are the ruins of Matibamba. Throughout the site area there are the remains of low walls and terraces covering the arid hillside. Because of lack of water en route from Chilia, the presence of *veruga*, very high temperatures, and other special problems imposed by the location of the site, we were unable to make the full survey that the area deserves.

The most interesting structures at Matibamba are the remains of five *chulpas* in the western part of the site area about 250 meters from the Marañon. One of these is almost perfectly preserved, although any burials it may once have contained are now gone. The well-preserved *chulpa* is a small two-story building—a square room or tower set on top of a round base. The base is constructed in the form of a semi-circle on the very steep hillside, the top being flush with the hill while the lower northern side is about 3 meters high. The diameter from east to west is approximately 6.2 meters, while the radius from north to south is 4.3 meters. The construction of the lower walls is a rubble and earth fill with stone facing. The facing stones are of varying size and are not coursed. This wall varies in thickness from a little more than 1 meter to more than 2 meters. Within the round lower structure there are two chambers entered from a small opening at the west corner. The northern and larger of these is in the shape of a half-moon about 3.4 meters in length and 1.7 meters in width having a maximum height of 1.25 meters. An opening into the smaller southern chamber is found at the northeast side of the larger, opposite the opening to the outside. The inner chamber is rectangular, about 3.2 meters in length by 96 cm in width with a maximum height of about 75 cm. At the eastern end of this chamber there is a window roughly 60 cm square. Both of the lower chambers have corbelled roofing which provides the floor for the structure above, additional support for this roof being supplied by the wall separating them.

The upper story of the *chulpa* is a boxlike building 2.84 meters square (Fig. 8, *b*), having a single window on the eastern side 58 cm square about 60 cm above the ground. The walls of this building are roughly 37 cm thick, being constructed in a pattern of three courses which repeats itself three times in the 2-meter height of the walls. This begins at the bottom with a course of very large faced stones in the neighborhood of 30 cm in height placed side by side but filled with smaller stones where necessary because of their irregular shape. Above this course is an area of flat stones, also faced, typical of the small stone layers of the alternating large and small courses found at Charcoy. This layer fills in and around the large lower layer making a relatively level surface on which there is a course of large flat stones measuring about 12 cm by 40 cm. The pattern is then repeated with a new layer of the very large irregular stones. The placement of the window and the height of the pattern are so arranged that the bottom of the window and the lintel over it are supplied by consecutive courses of the long flat variety. On the whole the pattern is followed consistently on all four sides, but there are occasional irregularities. The roof of the upper level is also corbelled, being 70 cm thick and constructed of large flat stones very irregularly placed without mortar.

Farther to the west there are three additional *chulpas* in a very bad state of disrepair. These are placed in a row on the hillside, one below the other. A fifth *chulpa* lies some distance up the hill to the south of the well-preserved example, and a closer examination of the ruins will probably reveal more.

Although the well-preserved *chulpa* is on the unterraced hillside, 8 meters up hill there is an artificially leveled area about 10 by 3 meters protected by a stone retaining wall on the upper side. On this level there are the remains of a rectangular structure. The only remaining wall in good condition is in the shape of an "L" about 2.7 meters high at the corner and 2 meters long toward either arm. This wall has a projecting corbel about 40 cm from the top.

At the eastern end of the Matibamba ruins there is another wall in excellent preservation. This appears to be the remains of a rectangular building about 6 meters high standing on an artificial terrace. This "*iglesia*," or temple, as it is called locally, appears to have once had two stories and in many respects to be similar to the large central structures at Charcoy and Pueblo Viejo.

SITES SOUTH OF CHILIA VALLEY

Matibamba is the last of the seven sites examined along the north rim of Chilia Valley. According to local reports and examination from the distance there are fewer sites along the corresponding ridge to the south. The most prominent of these is Ushcun (see map, Fig. 1), lying on the southern ridge overlooking the Ruyabamba opposite Corrales de Piedras on the north. Some stone sculpture and burials are reported there.

Still farther to the south, the extensive ruins of Colpan are found at the height of a pass between the valleys of the Aullobamba and the Nahuinbamba. These ruins consist of buildings and terraces similar to those examined in detail. Another similar group of ruins is Huancuy, found about 15 km south of La Paccha on a high point ringed with concentric terraces. This ruin is located just above Cachipicza on the valley floor and seems designed to protect the pass where the present trail crosses the shoulder of the mountain into the valley of the Nahuinbamba. This site was visited by Raimondi in 1860.[3]

PIRURO

To the north of the valley of Chilia, the site of Piruro presents a classic example of the hilltop structures found in Pataz (Fig. 7, *c*). It lies about 500 meters to the northwest of the mule trail from La Viña to Alpamarca at the height of a small pass about 3,200 meters in elevation immediately before the final descent into the Parcoy valley. The situation is very striking for its location, giving a clear view up the valleys of the Ariabamba and Yurayaca as well as a large part of the valley of the Parcoy. Approaching by way of La Viña, Piruro is visible from the trail for several hours before actually arriving at the site.

The structure itself consists of a large oval platform about 90 meters long by 50 meters wide. The sides of the platform now slope down to the hilltop about 8 meters below, but they may once have been faced with stone. On top of the platform there is a truncated pyramid about 8 meters high, being roughly 12 meters in diameter at the top. There are some sections of former retaining walls, but in most places these have been removed for modern buildings or walls. On the west side of the pyramid, where the walls are best preserved, there are indications that the sides once rose in four steps about 3 meters wide. All the remaining walls are of normal *pirca* construction with no pattern of large and small stones. Although a large number of well-cut rectangular stones were found near the site, none of these were in place. On the eastern side a treasure-seekers' excavation has completely removed a large part of each level.

PARCOY VALLEY

In addition to Piruro there are other sites in the vicinity of the Parcoy valley, though they were not examined in detail by the expedition in 1949. Rumatambo, overlooking the Parcoy near the Hacienda "El Tra-

[3] RAIMONDI, ANTONIO. *El Peru* **5**: 125. Lima, 1874–1913.

piche," is one of these. The portion visible from the valley below is a retaining wall system circling a hilltop at about 3,100 meters in elevation. Santisteban is reported on the ridge between the rivers Yurayaca and Ariabamba but was not examined.

Along the south bank of the Lagarpampa or Sauce River, which empties into the Marañon 1 km north of La Viña, there is a series of parallel agricultural terraces, formerly watered by an irrigation canal bringing water from the upper Lagarpampa. In all, about 40 levels can be distinguished along the slopes above the Marañon. These are not only the most extensive system of terracing observed in the Pataz area but also the only system of parallel terraces, the others being only the concentric type. They are, perhaps, noteworthy as the only possible remains of Inca occupation, the other features of architecture, ceramics, and sculpture being clearly non-Inca in character.

HUILCAYACO CAVES

In addition to the ceremonial and habitation sites visited, investigations were made at two burial sites, both caves. The largest of these was visited by Raimondi (*loc. cit.*) at the same time he visited Huancuy. Continuing beyond Huancuy on the trail toward Nahuinbamba the cave is located between the mule trail and the Río de Nahuinbamba about 2 km past the site of Huancuy. It lies on the side of a very steep bluff about 3 km in a direct line from Huaylillas at an elevation of about 2,800 meters. Although the cave is difficult to find without local assistance, a guide can be secured in any nearby village by asking for the *cueva de los gentiles*. At the mouth the cave is only 1 meter wide by 50 cm high, the entrance sloping downward at an angle of about 20 degrees. Once inside it is somewhat bigger and finally at the depth of about 15 meters there is a room large enough for standing upright. Various side passages open in several directions from the central tunnel. In all parts of the cave, but especially in the first large room, there are numerous human skeletons. The cave shows signs of having been frequently entered in the past, but some of the skeletons were still partly articulated. No artifacts were found.

SHAHUINDO

The second burial caves examined are located on Hacienda "El Trapiche" not far from the site of Piruro. The caves are in the steep cliffs of Shahuindo about 1 km northwest of the hacienda buildings and 100 meters higher in elevation. They can be reached from the hacienda without the aid of ropes. Three caves open from a narrow off-set in the cliffs, bearing 308° magnetic from Trapiche Viejo. From south to north they have been numbered I, II, and III. Cave I has an entrance 1 meter in width by 20 cm in height. The floor is covered with unarticulated human bones mixed with earth. The whole has the appearance of having once been excavated and later replaced. At present the cave can be entered about 3 meters. No artifacts were found, but a thorough excavation of the floor might uncover much more than our brief examination revealed. Caves II and III are similar in size and condition. They are located 10 and 12 meters respectively to the north of cave I.

Other burial caves were reported in the Pataz area but were not visited. The burial caves at Ushcun are mentioned above. Caves were also reported near the headwaters of the Quishuar about 10 km to the northnortheast of Chilia village. Other caves are supposed to exist in the southeast slope of Nunamarca bluff, but could not be found in 1949.

SUMMARY AND CONCLUSIONS

Within the area under consideration the following types of structure occur:

(*a*) Series of concentric terraces ringing a hilltop.
(*b*) Artificial platforms with sloping sides and with vertical stone faced sides.
(*c*) Artificial platforms superimposed in the form of a stepped truncated pyramid three or four layers in height.
(*d*) Earth embankments faced with stone accompanied by moats.
(*e*) Rectangular houses.
(*f*) Round houses about 1 m. high and 3 to 4 m. in diameter.
(*g*) Large rectangular buildings up to 5 m. in height.
(*h*) Depressed plazas or reservoirs.
(*i*) Galleries.
(*j*) Stone lined shafts.

(*k*) Large circular enclosures surrounding groups of circular houses.
(*l*) *Chulpas*.

Five general types of masonry were observed in the Pataz region:

(*a*) Unfaced rough *pirca*.
(*b*) Faced *pirca* built with average uniform stones.
(*c*) Faced *pirca* built with large and small stones in alternate courses.
(*d*) Faced *pirca* of large stones placed at random throughout a wall of smaller stones.
(*e*) Faced *pirca* having a three-course repetitive pattern.

These masonry types are used either in walls completely of stone or as facing for clay and rubble walls or in retaining walls. Two additional features of the local stonework are the use of decorative corbels near the top of walls and of the corbeled roof.

Although a reconnaissance survey of this sort can not be comprehensive, even for an area as small as central Pataz, it allows limited conclusions about the type of architecture and the extent of archaeological remains to be found in the trans-Marañon region of Peru. But these conclusions must be very tentative, since the areas immediately surrounding Pataz on all sides have not been explored by archaeologists, even at the survey level. Particularly the southern part of Pataz, the provinces of Marañon and Pomabamba, and the general area between central Pataz and Chavin de Huantar merit a careful examination. Large ruins are reported at Tarrija and Uchos in southern Pataz and at Llayno near the town of Pomabamba. Even surveys in these areas would help to clear up many problems connected with the appearance in Pataz of traits associated with the cultures of the Callejon de Huaylas.

Among these traits, only to mention the most obvious, are stone-lined galleries, houses that were probably two-storied, and emphasis on the feline motif in stone sculpture.[4] The preponderance of round house outlines about 1 meter high and 3 meters in diameter as the ancient dwelling-house type in Pataz calls for special mention. The author observed nothing of this sort in current use in Pataz, but this type, though uncommon, is still used in parts of the Callejon de Huaylas. In these present-day buildings, the base is a rough stone wall approximately the same height and diameter as those in Pataz, while the roof is a conical thatching supported by a vertical pole in the center, 4 to 5 meters high.

On the other hand, the Matibamba *chulpas* present a problem that must be left till further exploratory work is done. This type of square boxlike structure on a round base is striking, yet no examples have been reported in the surrounding regions, that is to say, at Chavin, in the Callejon, at Marca Huamachuco, or in the region of Cajamarca.

On a more general plane, the whole area of Pataz seems to have been formerly more heavily populated than it is today, even if it is assumed that all sites in the valley of Chilia were not occupied at the same time. Of the sites visited only Matibamba and Lagarpampa are not equipped with defense works or located in easily defensible positions. Several of the sites, notably Charcoy and Pueblo Viejo and Huayan, are located at almost 4,000 meters elevation, far above the arable area and far above any visible source of water. This raises the question of the prehistoric political situation. Against whom were these defenses built? A tentative answer is suggested by Garcilaso's statement that the pre-Incaic boundary between Huacrachuco and Chachapoyas was found just to the south of Pías.[5] If this is true, the long valley of the Parcoy and Alpamarca Rivers forms a natural frontier. The heights to the south and west of the Parcoy, then, would be the natural defense line of Huacrachuco. It is possible that the chain of fortifications to the north of Chilia valley housed only garrisons. This would explain both the relative density of population on this ridge and the inaccessibility of the sites. Following this hypothesis only the sites on or near the valley floor like the Canta sites and Nunamarca would be economically supported by the production of Chilia valley. The garrison sites could have been supported by a much larger area.

[4] BENNETT, WENDELL C. *The North Highlands of Peru*. New York, 1944.

[5] DE LA VEGA, GARCILASO (El Inca). *Comentarios reales:* pt. 1, bk. 8, chap. 1. Buenos Aires, 1945.

PALEONTOLOGY.—*Check list of salinity tolerance of post-Paleozoic fossil Ostracoda.*[1] I. G. SOHN, U.S. Geological Survey. (Communicated by J. S. Williams.)

Among microfossils Ostracoda are considered second only to Foraminifera as horizon markers. Their utilitarian value is enhanced by the fact that they occur in both fresh and salt water, whereas the Foraminifera are confined to salty waters. Although certain genera of ostracodes show remarkable tolerances to variation in salinity, none of the species belonging to those genera has to date been recorded as tolerant to both strictly fresh and strictly marine environments. Some species can live in water that grades from fresh to brackish; others tolerate brackish to marine water. Many genera and species are reported to be confined to each one of the several types of salinity environments.

The following table records the inferred salinity tolerance of 80 forms included in 36 genera. The species are those for which salinity habitat is specifically mentioned in the literature. The table is compiled as an aid to interpreting the depositional environment of sediments containing post-Paleozoic Ostracoda. It is the result of an objective survey of the literature and consequently may include some erroneous inferences, which future investigations will rectify.

[1] Published by permission of the Director, U. S. Geological Survey.

LIST OF POST-PALEOZOIC FOSSIL OSTRACODES FOR WHICH A DEFINITE SALINITY HABITAT HAS BEEN INFERRED

Ostracode	Type of Water			Remarks	Reference
	Fresh	Brackish	Marine		
Amonocythere		×			21
A. floridana			×		21
Bairdia oviformis			×	Shallow warm water.	20
Bythocypris			×		17, 24
B. simulata			×	Shallow water.	6
Bythocythere simplex			×		19
Candona ansata	×	×			22
C. bononiensis	×				22
C. forbesii	×	×			11
Cyprella			×		4
Cypridea	×	×		Thin shells fresh, thick shells brackish (10).	4, 10, 15
C. dunkeri	×	×		Slightly saline (1).	1, 22
C. granulosa		×			1
C. ganulosa var. *fasciculata*		×		More saline than next below.	1
C. granulosa var. *paucigranulata*		×		Less saline than above.	1
C. primaeva	×				22
C. punctata	×	×		Slightly saline (1); fresh water (22).	1, 22
Cyprideis		×			15
Cypridopsis compressa	×				8
Cyprione bristovii	×				1
Cypris purbeckensis	×				22
C. pygmaea	×				22
Cythere		×	×	Marine-brackish (3, 7); marine (12, 23).	3, 7, 12, 23
C. cornuta			×	Shallow sea.	18
C. crispata		×	×		7
C. drupacea			×	Shallow water.	6
C. limicola			×		19
C. retirugata		×	×		22
C. transiens		×	×		22
C. tuberculata			×		19
C. visceralis			×		22
Cythereis	×	×	×		16
C. conveza var. *sarmatica*		×			13, 24
C. ornatissima			×	Shallow sea.	18
C. serpentina			×		22
Cytherella			×	Typical marine.	17
C. muensteri			×	Shallow sea.	18

LIST OF POST-PALEOZOIC FOSSIL OSTRACODES FOR WHICH A DEFINITE SALINITY HABITAT HAS BEEN INFERRED—*Continued*

Ostracode	Type of Water			Remarks	Reference
	Fresh	Brackish	Marine		
Cytherelloidea williamsoniana			×	Shallow sea.	6
Cytheridea		×	×	Shallow marine, estuarine.	3, 7, 12, 14
C. calyptroides			×		22
C. eusarca		×	×		22
C. helvetica		×			14
C. hungarica		×			24
C. longicaudata			×	Shallow water.	6
C. mulleri		×	×	Shallow sea, temperate zone (20).	11, 20
C. aff. *C. mulleri*		×		Fresh-water influence.	9
C. politula			×		22
C. torosa		×			5
C. torosa var. *litoralis*		×			13
C. williamsoniana		×	×		14
Cytherideis			×	Typical marine.	17
C. unicornis	×	×		Fresh or slightly brackish.	11
C. unisulcata	×	×		Fresh or slightly brackish.	11
Cytheropteron		×	×	Marine-brackish (3); typical marine (17).	3, 17
C. sp.		×	×	Marine or estuarine.	22
C. elongata-concentricum			×	Shallow water.	6
C. virgineum			×	Shallow sea, temperate zone.	20
Cytherura		×	×		16
Darwinula leguminella	×				1
D. liassica	×	×		Either fresh or brackish.	12
Eucytherura			×		17
Herpetocypris aequalis	×				7
Krithe		×	×	Shallow marine or estuarine.	7, 24
Limnicythere zindorfi	×	×			14
Loxoconcha elliptica		×			5
Macrocypris horatiana			×		22
M. simplex			×	Shallow water.	6
Macrodentina		×	×		10
Nesidea			×	Typical marine.	17
Orthonotacythere			×		15
Paracypris			×	Typical marine.	17
Paracythere			×	Typical marine.	17
Pseudocythere			×	Typical marine.	17
Rhinocypris scabra var. *hamata*	×				22
Scabriculocypris acanthoides	×				22
S. cerastes	×				22
S. trapezoides	×				22
Schlerochylus			×	Shallow lagoon, approaching littoral.	24
Thaumatocypris bettenstaedti			×	Up to 200 meters deep.	2
T. feifeli			×	Shallow water.	2

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BOTANY.—*Peter Wilhelm Lund's pequi tree at Lagoa Santa and pilgrimages to his cemetery.*[1] ANNA E. JENKINS, U. S. Department of Agriculture, A. A. BITANCOURT, Instituto Biologico, São Paulo, K. SILBERSCHMIDT, Instituto Biologico, and W. ANDREW ARCHER, U. S. Department of Agriculture.[2]

"Trees by their very nature are landmarks and memorials. They are therefore identified with human happenings. Also, trees, having more than the alloted span of man, carry their associations through generations of men and women. Thus they often figure not only in biography but also in

[1] Among the desiderata we assembled mostly in 1941 for the preparation of this article is a letter (Dec. 6, 1941) from James A. G. Rehn, corresponding secretary of the Academy of Natural Sciences of Philadelphia, in which he wrote as follows: "I have your letter of the 3rd about Peter Lund, whose name of course was reasonably familiar to me on account of his work on the fossil deposits at Lagoa Santa. He was elected a Correspondent of our Academy January 29, 1850, and our records give his death as having occurred May 25, 1880. Correspondents of the Academy are elected from scientists non-residents of Philadelphia, who have achieved outstanding distinction in work in the natural sciences. A very considerable part of all the great workers in our field in the last century and a quarter were Correspondents of the Academy, although the number in this class at any one time is naturally limited, and rarely has exceeded 150." This article therefore commemorates the centenary of Dr. Lund's election as a Corresponding Member of the Academy of Natural Sciences of Philadelphia.

We are indebted to Dr. Elisabeth Deichmann, Museum of Comparative Zoology, Harvard University, for a critical reading of the manuscript.

Miss Deichmann's mother was P. W. Lund's grand-niece. She was 11 years old when he died, but her whole childhood was flavored by stories about this distant uncle who kept up the contact with his family in Denmark until his death.

[2] In 1935–36 the first writer was on a mycological mision to Brazil, at the invitation of the government of the State of São Paulo, and was working cooperatively with the second writer at the Instituto Biologico. The fourth writer was completing a plant exploration mission to South America.

history." So wrote Randall and Edgerton (*16*)[3] in their *Famous trees.*

Of trees associated with "notable persons, events, and places" is the beautiful pequi (*Caryocar brasiliense* Camb.)[4] growing beside the tomb of Peter Wilhelm Lund (1801–1880)[5] at Lagoa Santa, Minas Gerais, Brazil. The actual existence of this tree and its rôle in the life of this noted Danish scientist may well have been disclosed to many readers only through brief mention of it in one or another of Prof. Anibal Mattos compilations of 1935 (*9–12*). These mark the centenary celebration of the savant's arrival at Lagoa Santa. In 1930 the original tomb had been replaced by a monument "which would signify the gratitude of the people of Minas for the valuable works of the great scientist." This was erected under Professor Mattos' direction at the commission of the governor of the State.

In his address at the unveiling of the new monument to Lund, the representative of Denmark stated that the site of the monument is the same as that acquired by the savant and that the parcel of cerrado[6] is entirely enclosed (*11*, p. 22). "At one side of the monument," he continued, "is the 'frondoso pequy' under the shade of which the scientist used to study." Mattos (*11*, p. 28) wrote that during the course of its construction a vase of flowers and a branch of the pequi were deposited in the tomb by Sra. Carlos Correa and Sra. Mattos. Because of its location and its low, broad head, the tree forms an important part of the composition in two of Mattos' photographs taken within the cemetery (*9*, opposite p. 57, also reproduced in *10*, opposite p. 32; *9*, opposite p. 80).

Our introduction to the pequi by Lund's monument was in 1936, when we were privileged to make a pilgrimage to his grave.

As guests of Dr. José de Mello Soares de Gouvea, director of the Department of Agriculture of Minas Gerais, the first three of the writers made the tour from Belo Horizonte on February 2. We had attended the "First Meeting of the Plant Pathologists of Brazil" held in Rio January 20–25, then visited the Escola Superior de Agricultura at Viçosa,[7] Minas, and were returning to Rio and São Paulo, via Belo Horizonte. The fourth writer's pilgrimage to the cemetery was made on August 3, as the guest of Dr. Henrique L. de Mello Barreto, botanist of the State Agricultural Department.[8]

As an introduction to Lagoa Santa we are here quoting from the preface of Warming's (*22*, p. 455) *Lagoa Santa*, as well as reproducing the map (Fig. 1) there cited.

> Lagoa Santa est un petit village de l'état brésilien de Minas geraës. Il est situé à 19° 40′ de latitude Sud, au Nord-Nord-Ouest de Rio de Janeiro (voir la vignette du titre et la carte p. 267). C'est là qu'habitait, depuis 1835 jusqu'en 1880, annee de sa mort, le zoologiste et paléontologue

[3] Reference is made by number (italic) to Literature cited. p. 74.

[4] Described in Saint-Hilaire (*18*, p. 322, pl. 67 bis). The illustration is reproduced in Jenkins' "Introductory Essay" accompanying Saint-Hilaire's "Esquisse de mes Voyages au Brésil et Paraguay" (*20*, fig. 4).

[5] For an extended biography of Lund cf. Reinhardt (*17*). A brief obituary notice (*1*) is quoted below:

"On May 25th died, at Lagoa Santa, in Brazil, the Danish philosopher and zoologist, Dr. P. V. Lund, aged nearly 79. Born in Copenhagen he graduated at the Copenhagen University, and was intended for the medical profession. He was soon diverted from this pursuit, however, by his interest for natural science, and when, in 1825, he gained a double golden medal for some zoological prize essays, he made a definite choice between the two. Ill health made him seek a milder climate in South America; and after a short stay in Rio Janeiro he returned to Europe, travelled to Italy with J. F. Schouw, the Danish botanist, and Mr. Harewood, and spent some years in France, where he became a friend of Cuvier. In 1832 he went out again to Brazil, and thenceforward lived in the small town of Lagoa Santa, in the province of Minas Gerais. The remarkable caves near this place, containing fossil remains of the Brazilian fauna from the Tertiary period, were discovered by Dr. Lund; and the paleontological collections he made in them were presented by him in 1854 to the Danish State, and now form a separate and much appreciated section of the Zoological Museum of Copenhagen.

"Dr. Lund also transmitted to Copenhagen many specimens of birds from the vicinity of Lagoa Santa. Prof. Reinhardt's well-known essay on the bird-fauna of the Campos of Brazil was based mainly upon Lund's collections." (Cf. also Pinto, *15*.)

[6] A recent description of "campo cerrado" is that by Bezerra dos Santos (*2*, pp. 141–144).

[7] Our host on this occasion was Prof. A. S. Muller, then plant pathologist and acting director of the Escola, now on the staff of the Escuela Agricola Panamericana at Tegucigalpa, Honduras.

[8] We are pleased to express our thanks and appreciation to Dr. Soares de Gouvea and to Dr. Mello Baretto for the hospitality they so generously extended.

danois très connu, P. W. Lund, et c'est de là qu'il dirigeait la publication de ses belles et fort importantes recherches sur les animaux fossiles des cavernes calcaires du Brésil (comp. l'index bibliographique). Lagoa Santa fut visité trois fois par le zoologiste danois, M. le Prof. Joh. Reinhardt, qui y passait chaque fois un temps assez long. Moi-même, étudiant, au début de mes études de botanique,—il y aura bientôt trente ans,—j'y ai vécu, dans la maison de Lund, trois belles années de ma jeunesse (1863–1866). Je rappelle ma jeunesse afin qu'on veuille bien ne pas coter trop haut les imperfections des observations que j'ai faites et que je communique dans ce mémoire. Lagoa Santa fut visité également par plusieurs autres explorateurs et savants, venus notamment pour voir Lund et lui rendre visite (v. p. 162), de sorte que ce misérable hameau est devenu en quelque sorte un endroit classique dans l'histoire des sciences.

On February 2, upon reaching the outskirts of Lagoa Santa, our host halted a few moments in order that we might view the lake for which the hamlet is named (Fig. 2, A) and concerning which there are so many legends (cf. *10*, pp. 19–25).

The story of Lund's taking up his abode in Lagoa Santa and of his owning a piece of cerrado in the neighborhood was recounted by Mrs. Agnes Chase (*5*) following her pilgrimage to the old tomb. "A few hours north of Bello Horizonte is Lagoa Santa," she began, and continued:

Lund was a consumptive who went to Brazil [1825] for his health. After a few years he returned to Denmark cured, but the disease again attacked him and he returned to Lagoa Santa to die. Being a Protestant he could not be buried in the cemetery, so he bought a piece of ground about 5 kilometers from the village for his grave. He lived 40 years after that, and buried Claussen,[9] and another friend and his two Danish servants in his little cemetery before he himself was buried there in 1880 at the age of 79. The few acres inclosed form a precious preserve of the original campo. Except for four immense clumps

[9] Lund's three secretaries were the Norwegian Brandt, his own countryman Warming, and the German Berens, and Brandt and Behrens were buried in Lund's cemetery (*9*, p. 91). Claussen returned to Europe and died in London in 1855 (cf. *21*, p. 11). We are making this correction here at Mrs. Chase's suggestion. The names were not clear on the old tomb, she explained to us, and she understood that Claussen was buried in Lund's plot.

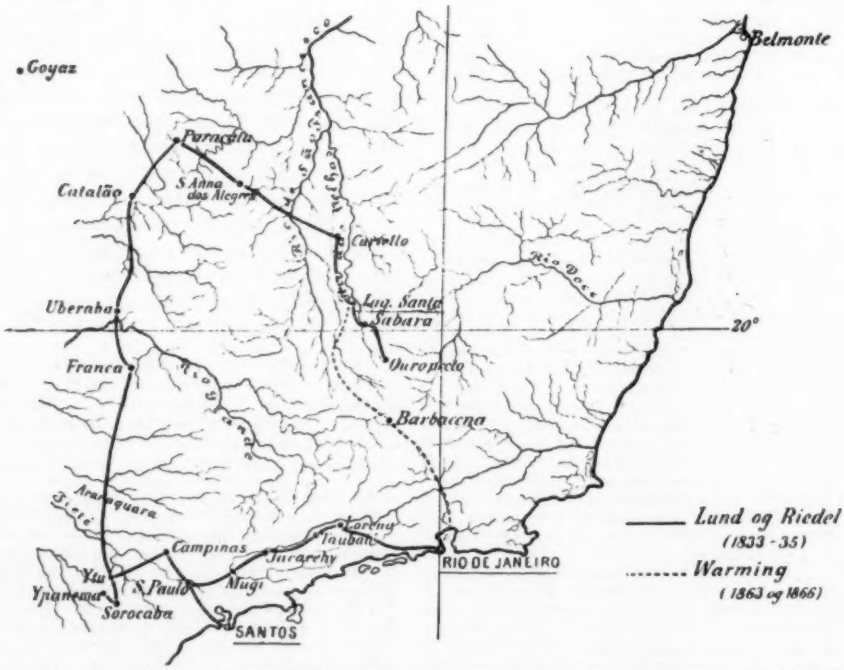

FIG. 1.—Location of Lagoa Santa as shown on Dr. Eugene Warming's map accompanying his *Lagoa Santa* (*22*, p. 267; *23*, p. 101).

of bamboo, the ground is left wild—the best kind of memorial to Pedro Lund. He was dearly loved by the Brazilians, and women still come to the cross to pray for the soul of the Protestante.

In further detail of her visit to the old tomb on March 25, 1926, Mrs. Chase has told us that fresh flowers, then wilted, had been placed at the foot of the cross. Her photograph (*5*, pl. 8, fig. 2) shows the cross in its position outside the "Campo Santo" as one author (*9*, p. 53) referred to the old cemetery. In the new enclosure the cross stands in line with the tombs of Lund and his assistants and to the rear (see Fig. 3, B). Painted black, it is of "aroeira" (mastic-tree) and has the date of Brandt's death, "1862," engraved on it, as Dr. Mello Barreto has informed us.

At the cemetery one not only pays homage to Peter Lund and his beloved assistants, but he at once senses that the pequi growing so near the plot selected by the naturalist for his grave must have been an intimate tree-friend. Breaking the silence as if reading our thoughts our host said, "Lund used to sit under that tree while engaged in study."

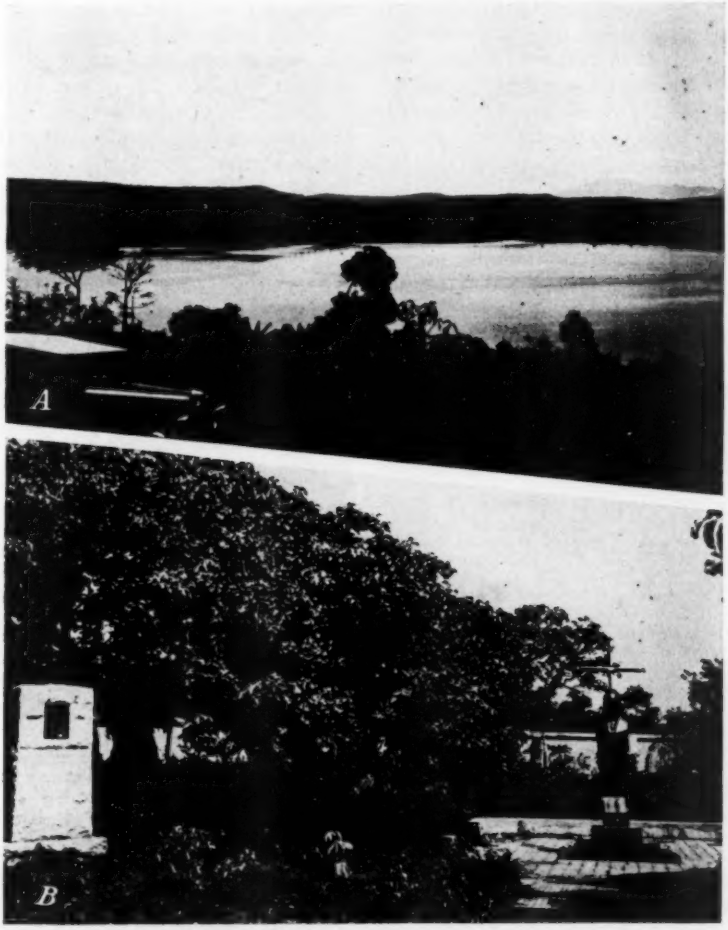

FIG. 2.—*A*, The lake at Lagoa Santa. *B*, The cemetery of Dr. Peter Wilhelm Lund; at right, monument surmounted by a bronze bust of the savant; in left foreground, Warming memorial; at left, the pequi. Photographs by Bitancourt, February 2, 1936.

The tree was in full leaf on February 2 (Fig. 2, B). On August 3, however, it was completely defoliated, with the recently dropped leaves lying on the ground below. In describing the vegetation of Lagoa Santa in spring (August-October), Warming (*23*, p. 228)[10] mentioned *Caryocar brasiliense* as one of the trees that drop all their leaves, then immediately leaf out.

Lund's pequi was conforming to this pattern when the fourth writer saw it on August 3. He painstakingly oriented his camera to include as much as possible of the pequi's odd, tortuous frame (Fig. 3, A).[11] He noted, too, the deeply furrowed bark, less well shown in the photograph. It so happens that the head of another bare pequi forms the background in his photograph of the monument to Lund (Fig. 3, B). In its defoliation this tree exposes a few epiphytes.

In Mrs. Chase's photograph of the old tomb (*5*) taken on March 25, 1926, the tree is in its usual luxuriant foliage casting a heavy shadow on the ground beneath. In Mattos' corresponding illustration the pequi is leafless. In both cases it is shown only in part, at the left, and the legends refer only to the tomb.

References to the tree in the legends accompanying Mattos' illustrations of the new cemetery are as follows: "Visto do velho pequy a cuja sombra estudava o sabio dr. Lund" (*9*, opposite p. 57); "Herma do dr. Lund vendo-se ao fundo pequizeiro por elle plantado . . ." (*10*, opposite p. 32), and "O pequizeiro plantado pelo dr. Lund . . ." (*11*, opposite p. 80).

Our hosts of 1936 have assured us that the first of these legends, as just quoted, is the correct one. The pequi is a common plant of the cerrado, they remind us, and is very slow-growing. Substantiating the latter statement our colleague Dr. A. O. Drummond[12] wrote us in 1946 that his 6-year-old pequi at Viçosa was then only 70 cm high.

Warming (*23*, p. 62) named the pequi among trees of the cerrado of Lagoa Santa having an orchard-tree-like habit and attaining a height of 3–6 meters. It is perhaps the comparatively low stature coupled with the many-leaved, far-extending branches, that imparts to Lund's pequi its unforgettable aspect. The pequi of the cerrado of Mogy-Mirim, São Paulo, illustrated by Hoehne (*8*, p. 86) is more erect and apparently taller. Dr. Mello Barreto tells us that he has seen pequizeiros 10 meters high and that Riedel cited examples reaching 13 meters.

Still another illustration of the pequi tree[13] has the following informative legend:

> The 'pequi' tree—*Caryocar Brasiliense* Camb. One of the many fruit-bearing trees of the cerrado of Brazil, which in its habit shows us what nature proportions to plants subject to incessant, harmful fires. Their fruits are, however, most useful and are the base of various drinks and condiments [translation].[14]

Dr. Drummond's letter already cited contains the following observations relative to pequi fruit: "In localities where the tree is native its fruit is much appreciated by the inhabitants; it does not appeal to those unaccustomed to its wild flavor. The seed is covered with small spines, which are easily freed and which pierce the tongue slightly. A dentist told me that when he lived at Cardisburgo, a small village in the cerrados

[10] During his visit to Belo Horizonte, the fourth writer was presented with a copy of Lofgren's translation into Portuguese of Warming's *Lagoa Santa* (*23*). This volume, now catalogued in the Library, U. S. Department of Agriculture, has been a ready reference in the preparation of the present article.

[11] The monument to Warming shown in the left of this photograph was erected in 1934, through the inspiration of Dr. Paulo Campos Porto, by the Jardin Botanico, Rio de Janeiro. Its execution was aided by the Secretary of Agriculture of the State of Minas Gerais. The inscription on the monument is as follows:

ALTERI EGREGIO DANO NATURAE INDAGATORI
JOANNI EUGENIO WARMING
DVI DOCTORI LUND AD LACUM SANCTUM CONVICTOR
FLORAM AD BRASILIANAM PENITUS SCRUTATUS
OECOLOGIAE BOTANICAE EXSTITIT FUNDATOR
IN PERENNEM MERITI MEMORIAM
POSTRIDIE NONAS JULIAS
A. D. MCMXXXII
HORTI BOTANICI
AD
RIO DE JANEIRO
RECTORES

[12] Formerly on the staff of the Escola Superior de Agricultura de Minas Gerais, now of the Serviço Publico do Estado de Minas Gerais, Belo Horizonte.

[13] Arq. Bot. Estado São Paulo, n. s., **1** (5). 1943.

[14] For further information on the uses of the pequi in Brazil cf. Corrêa (*7*), Pereira (*14*), Netto (*13*), and others.

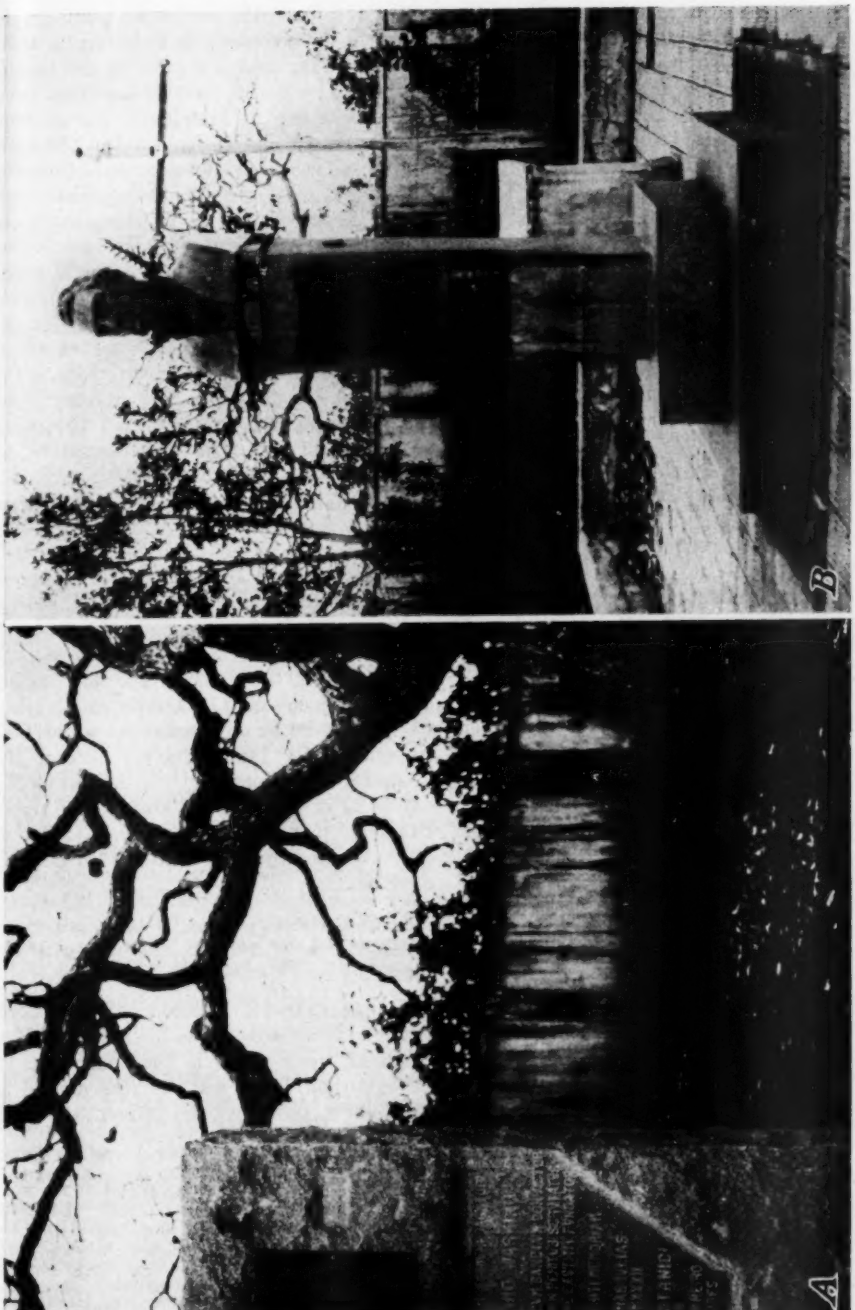

FIG. 3.—Closer views of the several monuments, August 3, 1936, showing (*A*) Lund's pequi, leafless, together with another leafless pequi outside the enclosure (*B*). Photographs by Archer.

near the famous Maquiné Caves, the main job he had was to remove the pequi spines from the tongues of the village children."

In his familiarity with the pequi that now grows beside his grave Dr. Lund must have known it in full leaf, almost momentarily leafless, in gorgeous flower, and then in fruit. The charm of the bloom is referred to by Chodat and Hassler (*6*, p. 809) in their account of the Caryocaraceae of Paraguay. To quote:

> L'unique Caryocaracée trouvée au Paraguay est le *Caryocar brasiliense* un arbuste habitant les campos secs au pied et sur le haut plateau de la Sierra de Maracaya où il est assez répandu. Sa fleur aux nombreuses étamines d'une couleur jaune paille s'ouvrant a l'àube, donne un charme tout particulier aux Campos pendant les heures matinales.

The numerous stamens are well shown in the line-drawing accompanying the original description of the species (cf. footnote 4). Their conspicuousness is again apparent from the herbarium specimen considerately sent to us by Dr. Mello Barreto[15] (Fig. 4). Collected at Belo Horizonte, November 7, 1941, by J. Evangelista Oliviera 630, this has been deposited in the herbarium of the U. S. National Arboretum. The only other accessions of this species in that herbarium are two from Minas collected in 1914 by P. H. Dorsett (1862–1943), A.D. Shammel, and Wilson Popenoe, plant explorers of the U. S. Department of Agriculture. The first specimen from Lavras, January 14, consists of fruit, and a tomentose stem with leaves. The second specimen, from Januaria, February 14, is of fruit only and the collector's note reads: "The fruit is just commencing to ripen. The pulp surrounding the seed is yellow and has a peculiar taste." Their photograph (February 4) of "a large pequi growing beside the road to Lagoa Santa" is shown in Fig. 4. The tree is "very common throughout this region," they noted.

In 1938, upon discovering that *Caryocar brasiliense* was not represented in the U. S. National Herbarium, the present writers contributed their "souvenir" of a cluster of the young, silken, 3-parted leaves from the tip of a branch of Lund's pequi, together with a representative set of photographs taken in the cemetery on February 2, 1936. To these they added a view of the nearby cerrado. The fourth writer's specimen from a blooming tree at Mendenha, Minas, September 24, 1936, was deposited in the same herbarium as its second accession of *Caryocar brasiliense*. This specimen is complete with fruit. We are gratified to note that more recently our small sample from Lund's tree has been supplemented by an ample specimen from a tree in flower at Lagoa Santa (U. S. Nat. Herb. no. 1933005). The descriptive label reads: "*Caryocar brasiliense* Camb. Tree 2–10 m. Flowers white. 'Pequi,' fruit edible, has a hard exocarp. The fruit is the yellow pulp around the spiny seed. Important tree in cerrado. In campo cerrado, near Lagoa Santa airfield.[16] Municipio of Lagoa Santa, alt. 850–900 m. Louis O. Williams, Vicente Assis, No. 7441. Sept. 10, 1945."

In response to our inquiry of 1941 we learned from Dr. Lyman B. Smith[17] that there were then three sheets of the *Caryocar* in the Gray Herbarium. All three specimens are historical, the earliest especially so because it was collected by Lund's countryman Claussen, who as circumstances willed, was responsible for Lund's having become the "founder of paleontology" in Minas Gerais (*4*) or as it is sometimes stated, "father of Brazilian paleontology" (*9*, p. 53; *10*, p. 307). As cited by Dr. Smith the three specimens are:

> Claussen, without number, Minas Gerais, 1840.
> Widgren, without number, Minas Gerais, 1845.
> Dusen, No. 15968, Jaguariahyva, Paraná, 1914.

Claussen's specimen could well have been collected from a pequi on his fazenda "Porteirinhas" near Curvello (see map, Fig. 1). It was upon Lund and Riedel's arrival at Curvello in 1834 that the "adventurer" (cf.

[15] Transmitted with his letter of November 11, 1941.

[16] For comparison with air travel to Lagoa Santa today, we cannot refrain from quoting here Warming's (*23*, p. 10) passage depicting his journey from Rio to Lagoa Santa (1863): "I left the 28th of May with the party of a farmer from the neighborhood of Lagoa Santa and, after 42 days' travel, glimpsed for the first time that unforgettable little place . . . [translation]."

[17] Then on the staff of the Gray Herbarium, Harvard University, now on that of the Department of Botany, U. S. National Museum.

FIG. 4.—Pequi growing beside the road to Lagoa Santa, Brazil, February 4, 1914, Dr. Popenoe posing in foreground. Photograph by Dorsett, contributed by the Division of Plant Exploration and Introduction, U. S. Department of Agriculture.

9, p. 9) Claussen encountered the two scientific travellers, thereupon inviting them to his fazenda, where they spent a week. This unanticipated visit led to Lund's becoming acquainted with the fossil-containing calcareous caves of the region (cf. *23*, p. 9). Our excursion to Lagoa Santa on February 2 included a visit to a nearby cave explored by Lund, namely, Lapinha Cave.

The specimen collected by Dusén (1856–1926) at Jaguariahyva is, of course, from the same locality where Saint-Hilaire discovered the pequi growing and in bloom (February 5) in 1820 (*19*, vol. 2, p. 50).[18] Neither record is cited in Hoehne's (*8*, 1930, p. 48) discussion of the cerrados of Jaguariahyva.

[18] The specimens on which Cambessedes [see footnote 1] description of *Caryocar brasiliense* is based were collected by Saint-Hilaire (1779–1851) "in campis prope S. Bento, in parte occidentali desertàque provinciae Minas Gerais, et Franca [see map, Fig. 1], urbem provinciae S. Paulo."

Our host of February 2 has told us that because of the botanical pursuits of Lund, Warming, and others at Lagoa Santa, this is the type locality of many different plants of the cerrado. "In consequence," he continued, "botanists come from far and near to re-discover, observe, and collect these same species."

Almost as he spoke, we noted the typical symptoms that follow infection by *Sphaceloma* on leaves of *Byrsonima coccolobaefolia* H. B. K. (Malpighiaceae) growing naturally in a small space before the cemetery. Journeying to Belo Horizonte soon afterward our colleague Dr. H. P. Krug[19] took advantage of the opportunity also to visit Lund's cemetery and again to collect material of the *Sphaceloma*. These specimens of February 2 and April 8, together with a

[19] Then plant pathologist at the Instituto Agronomico, Campinas, State of São Paulo, now on the staff of the Horto Florestal, Cantareira, State of São Paulo.

culture isolated from one of them, served as the basis of the description of a new pathogenic fungus, named for the locality, i.e., *S. lagoa—santensis* Bitancourt and Jenkins (*3*, p. 152, pl. 1).

The "Introduction" to Warming's (*23*, p. 17) classic *Lagoa Santa* closes with the following sentence: "When Lund, after visiting Claussen, was accompanying his companion Riedel to the capital of Minas, Ouro Preto, situated a few leagues to the southeast of Lagoa Santa, the lovely lake with its enchanting neighborhood so impressed him that, having traversed the desert regions of the interior, he involuntarily exclaimed: 'Here indeed: here is a good place for one to live,' perhaps forseeing that he was to live there for almost half a century and to find his final resting place in the shade of the trees of the campo [translation]."

The ancient pequi near the grave of Lund seems to assume the personality of a kindly sentinel, standing silent, protective, and serene.

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ZOOLOGY.—*Notes on the undescribed males of two species of Copepoda.* S. KRISHNASWAMY, Madras University. (Communicated by Paul L. Illg.)

In the course of a study of the Copepoda of the Madras coast, males belonging to two species, *Centropages trispinosus* Sewell (1914) and *Diosaccus truncatus* Gurney (1927), known so far only by the females, were discovered. A full description of these male types is given in this paper so as to complete the identification of the species. The types will be lodged in the Indian Museum at Calcutta.

I wish to record my grateful thanks to Dr. C. P. Gnanamuthu, director, Zoology Laboratory, Madras University, for guidance and help and to Lt. Col. R. B. Seymour Sewell, of Cambridge, for going through the paper and offering helpful criticisms.

Centropages trispinosus Sewell

Fig. 1, *a–d*

Centropages trispinosus Sewell, 1914, p. 223, pl. 23, figs. 5–8.

This species was established by Sewell in 1914, on the basis of a solitary female taken at Kilakarai in the Gulf of Manaar, South India, and has not until now been recorded since. While examining the plankton collected in July 1937 from Krusadai Island in the Gulf of Manaar I found several females and males. Large numbers were also found in the inshore plankton collected at Madras in July, August, September, and January.

Sewell (loc. cit.: pl. 18, fig. 7) has given the figure of the second swimming leg and is of opinion that the remaining legs resemble those of *C. alcocki* Sewell. The first swimming leg, however, differs from the second one and has the following structure: The exopodite is nearly twice the length of the endopodite. The first exopod joint carries one outer spine and one inner seta, the second joint one outer spine and one inner seta, and the terminal joint two outer spines, one long, finely serrate apical spine, and four inner setae. The first endopod joint has an inner seta, the second joint two inner setae, and the terminal joint five setae. The outer margins of the exopod as well as the endopod of the swimming feet are hirsute.

The description of the female holotype given by Sewell is fully corroborated by my observations of a large number of females except for the difference stated above.

Male (Fig. 1, *a*).—1.025 mm, smaller than the female.

Body yellowish red with dark red patches on the cephalothorax. A bright-red spot is present on the anal segment. Outline of body with the three spines on posterior corner of cephalothorax as in the female. The abdomen is 4-jointed, whereas in the female it is only 3-jointed.

The right antennule is geniculate and composed of 21 joints, having the following proportional lengths:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
11.	9.	3.	4.	6.	5.	4.	5.	6.	6.	4.	9.	12.	16.	13.	16.	15.	30.	35.	15.	25.

Seven of these joints (i.e., from the twelfth to the eighteenth) are very swollen. All the joints carry one or two setae each toward the outer side. These setae are short and thick, except those on joints 19, 20, and 21, which are long. The eighteenth joint is hinged to the nineteenth, and these joints each have a toothed plate toward the outer side. The inner distal end of the nineteenth joint has a protuberance, whereas the terminal joint is produced into a fingerlike process. The number of setae and their arrangement are as shown in Fig. 1, *b*. The antenna, mandible, maxillae, and maxilliped are as in the female. The first four pairs of swimming feet as in the female.

The fifth leg of the left side differs from those of the other species of the genus. The exopod is of two joints, the proximal joint has an outer spine, while the distal joint, which is nearly twice as long as the first joint, bears two outer and two apical spines, the outer ones being longer. The endopod is 3-articled and is shorter than the exopod. The first and second joints carry a plumose seta each, while the third has two inner, two outer, and two apical plumose setae (Fig. 1, *c*). The exopod of right fifth leg resembles those of the other members of the genus. The first joint bears a short outer spine, and the "chela" bears two spines one toward the outer side and one toward the inner side, and the outer margin is hirsute. The endopod is 3-jointed, and the first and second joints carry a plumose seta each, the third joint three inner, two apical, and one outer plumose seta (Fig. 1, *d*).

Remarks.—The presence of the spines on the posterior end of the cephalothorax is a distinct

feature that facilitates the identification of this species. The occurrence of this species at Madras is of interest because it was previously known only from Kilakarai, 300 miles south of Madras.

Diosaccus truncatus Gurney

Fig. 2, *a–d*

Diosaccus truncatus Gurney, 1927, p. 513, fig. 136; Sewell, 1940, p. 240.

Gurney described this harpacticoid in 1927 from the females collected by him at Port Said. In the Madras plankton collected on February 21 and 22, 1949, four males and two females were found. A night haul made at Kundugal channel (Gulf of Manaar) on March 22, 1948, yielded four males.

Male.—0.68 mm, distinctly shorter than the female, which measures 0.9 mm.

The rostrum is triangular and mobile. The second, third, and fourth thoracic segments have their lateral margins produced externally into winglike expansion. The abdomen is 4-jointed. The caudal rami are longer than broad, and each ramus carries three spines and an apical jointed seta, which is half as long as the body.

The antennules of the two sides are geniculate. Each antennule is 8-articled, the joints having the following proportional lengths:

1.	2.3–4.	5.	6.	7.8.
11.15.	5.	15.10.	10.8.	

The line of demarcation between the third and fourth joint is not clear. The fifth joint is very swollen and has a knoblike projection towards its proximal side. It carries an "aesthete" on its distal end. The sixth and seventh joints are hinged and

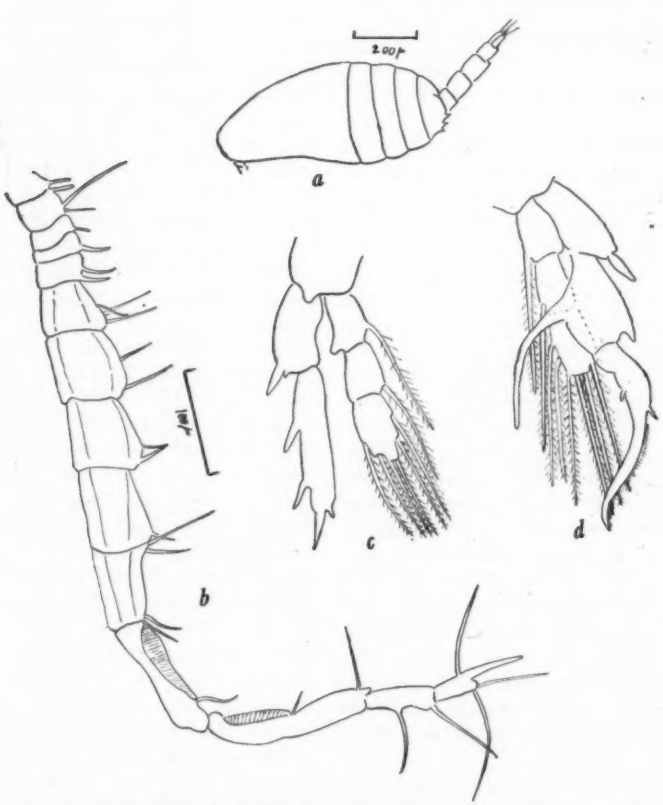

FIG. 1.—*Centropages trispinosus* Sewell: *a*, Lateral view; *b*, right antennule (from the seventh joint); *c*, fifth leg (left side); *d*, fifth leg (right side).

are armed with fine teeth on their inner edges. The arrangement of the setae is as shown in Fig. 2, *b*. The antenna, mouth parts, and the first swimming feet as in the female. The second swimming leg differs from that of the female in the exopod and endopod being of three and two joints and not three and three joints as in the female. Further, the outer margins of the first joints of the exopod and endopod are hirsute. The first and second exopod joints carry a serrate spine each on the outer side, while the third joint has three serrate spines and three setae. The second exopod joint has two inner setae also. The first endopod joint has a seta toward the inner side, while the terminal joints carries two spines and two setea, two of which are modified (Fig. 2, *c*). The third and fourth swimming legs as in the female. Fifth leg has the basal expansion completely fused and bears two unequal spines and three setae (Fig. 2, *d*: L_5). Sixth leg is rudimentary and is represented by a stout spine and two setae (Fig. 2, *d*: L_6).

Remarks.—The female of this species found at Madras is smaller in size compared with the form described by Gurney from Port Said. It is being recorded for the first time from the Bay of Bengal.

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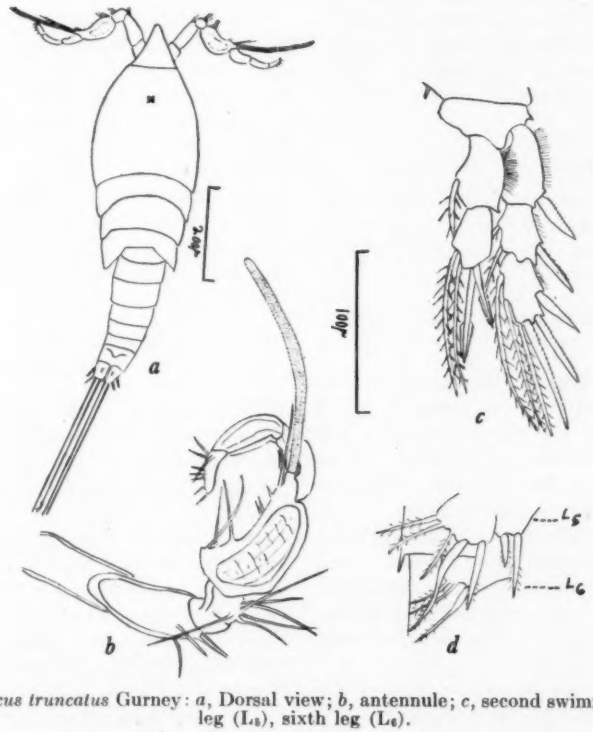


FIG. 2.—*Diosaccus truncatus* Gurney: *a*, Dorsal view; *b*, antennule; *c*, second swimming feet; *d*, fifth leg (L_5), sixth leg (L_6).

ZOOLOGY.—*New cleidogonid millipeds (Chordeumoidea).* NELL B. CAUSEY, Fayetteville, Ark. (Communicated by H. F. Loomis.)

Their dark color, retiring habits, and small size make collection of cleidogonid millipeds difficult, but with patience they can be found in almost any damp humus in the Mississippi Valley, the states east of it, and in Central America. Inasmuch as species are rather endemic, doubtless numerous others are yet to be discovered. A key to the genera will be found in the survey of the Family Cleidogonidae by Hoffman (1950).

I am indebted to Dr. M. W. Sanderson for the opportunity of studying specimens of *Cleidogona fustis* Cook and Collins and the type specimens of *C. inflata* and *C. unita*, all of which are in the collection of the Illinois Natural History Survey. The type specimens of *C. minima*, *C. aspera*, *Ozarkogona glebosa*, and *Tiganogona moesta* will be deposited in the collection of the Academy of Natural Sciences of Philadelphia. Unless stated otherwise, collection was by the author.

Cleidogona fustis Cook and Collins

The two male specimens from Turkey Run State Park, Montgomery County Ind., are in the Illinois collection. This is the only published locality of this species.

Cleidogona aspera, n. sp.
Figs. 1–4

This species is near *C. laminata* Cook and Collins in the structure of the gonopods and in the modification of the legs of the male. The two species are separated by differences in the longest processes of the gonopods, which are fimbriate in *laminata* and bifid in *aspera*.

Male holotype.—Color brown above and laterally, with the usual areolate buff maculae; cream below; legs cream except the tarsi, which are brown; antennae and vertex of head brown; ocelli dark, forming a triangular patch, arranged in rows of 7, 6, 5, 3, 3, 2, 1.

The ninth legs are almost as in *laminata;* on the mesial surface of the first segment is a deep, rectangular depression, its laterad surface and the area immediately distad finely granular. The glandular openings on the first segments of the tenth and eleventh legs are as in *laminata*. The sternal process at the base of the twelfth legs is distinctive in the shape of the spine (Fig. 1).

As in *laminata*, the ventral branch of each gonopod ends in three processes, the ventral one resembling the head of a bird, the longest one, unlike *laminata*, finely bifid distally, and the third and shortest one subquadrate and attached to the base of the longest process. The dorsal branch of each gonopod is somewhat flattened vertically; there is no notch on the medial face, as in *laminata*. Ventral, dorsal, and lateral views of the gonopods are shown in Figs. 2, 3, and 4, respectively.

Length about 20 mm, *width* 2.1 mm.

Female paratype.—Resembles the male in size and color; ocelli arranged in rows of 1, 7, 6, 5, 4, 3, 2.

Type locality.—Arkansas: Lawrence County, 6 miles east of Imboden on highway 62; 7 males and 7 females were collected from a dry oak-cedar area, August 22, 1950.

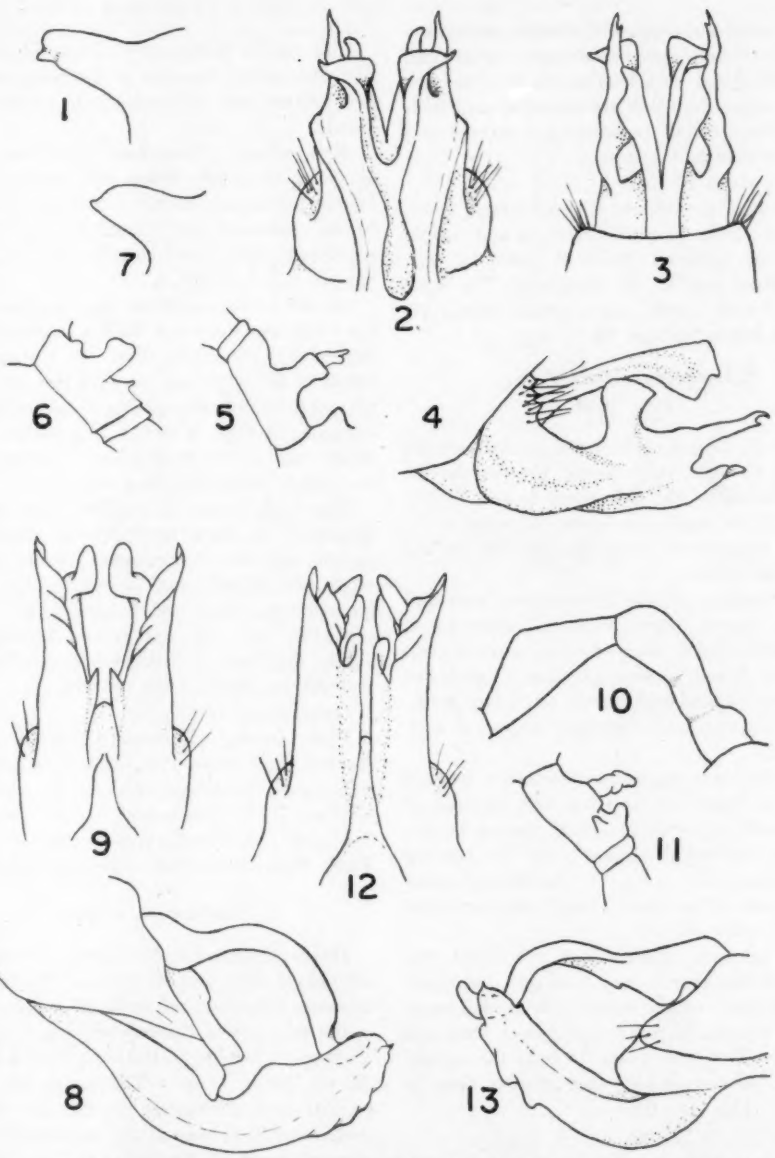
Other localities.—One male, Pocahontas, Randolph County, Ark., August 22, 1950. One male collected by Billy C. Rogers, Carthage, Dallas County, Ark., October 8, 1950, differs from the holotype in that the ventral processes of the gonopods are less like the outline of a bird's head and the ocelli are arranged in rows of 1, 7, 6, 5, 4, 3, 1, 1.

Cleidogona unita, n. sp.
Figs. 5–9

The ninth legs of the males of this species resemble those of *C. caesioannulata* (Wood) as drawn by Cook and Collins (1896), but the details of the gonopods are nearest those of *C. minima*.

Male holotype.—Color brown above and laterally, with the usual aerolate buff maculae, the prozonites lighter than the metazonites; cream below; legs cream except the tarsi, which are brown; antennae and vertex of head brown; ocelli dark, forming a triangular patch, arranged in rows of 7, 6, 5, 4, 3, 1 (2).

The ninth legs are as shown by Cook and Collins for *C. caesioannulata* (Wood). The first segments of the tenth and eleventh legs (Figs. 5, 6) have prominent cones on the mesial surface through which the coxal glands open. The sternal



FIGS. 1–4.—*Cleidogona aspera*, male paratype: 1, Sternal process at base of twelfth legs, lateral view; 2, ventral view of gonopods; 3, same, dorsal view; 4, lateral view of left gonopod.

FIGS. 5–9.—*C. unita*, male holotype: 5, First segment of tenth leg; 6, same, eleventh leg; 7, sternal process at base of twelfth legs; 8, lateral view of left gonopod; 9, ventral view of gonopods.

FIGS. 10–13.—*C. minima*, male holotype: 10, First two segments of ninth leg; 11, first two segments of eleventh leg; 12, ventral view of gonopods; 13, lateral view of right gonopod.

process at the base of the twelfth legs is shown in Fig. 7.

The gonopods consist of a wide, dorso-ventrally flattened ventral branch and a cylindrical, sigmoidal dorsal branch (Figs. 8, 9). The ends of the ventral branches are smoother and their medial longitudinal processes are shorter and narrower than in *C. minima*.

Length about 14 mm.

Type locality.—Illinois: Union County, Giant City State Park. The male holotype and two females were collected March 6, 1945, by Drs. H. H. Ross and M. W. Sanderson. The same collectors took a male and a female March 17, 1942, at Dixon Springs, Ill.

Cleidogona minima, n. sp.
Figs. 10–13

Although the gonopods of this species resemble those of *C. unita* very closely, the two can be distinguished by the differences in size, in the details of the medial processes and ends of the ventral branches of the gonopods, and by the legs of the males.

Male holotype.—Color brown above with buff maculae, cream below; segmental setae set in small buff maculae, those at medial setae largest; legs dark distally, cream proximally; antennae and vertex of head dark brown; ocelli dark, forming a triangular patch, arranged in rows of 7, 6, 5, 3, 2, 1.

The first two segments of a ninth leg are shown in Figure 10, and the first segment of an eleventh leg, with two small conical projections on the mesial surface above the opening of the coxal gland, in Fig. 11. The sternal process at the base of the twelfth legs is similar to the one in *C. unita* (Fig. 7).

Each gonopod consists of a cylindrical, sigmoidal dorsal branch and a larger, dorso-ventrally flattened ventral branch. The medial longitudinal process is rolled and larger than the similar process in *C. unita*. Distally the ventral branches are emarginate and sharper than in *C. unita* (Figs. 12, 15).

Length 11 to 12 mm.

Locality.—Alabama: Tuscaloosa. One specimen collected November 9, 1949, from under pine bark on the campus of the University of Alabama was sent to me by Dr. R. E. Crabill, Jr.

Cleidogona inflata, n. sp.
Figs. 14–19

This species is nearest *C. leona* Chamberlin, with the ventral branches of the gonopods large and inflated and the dorsal branches small and simple.

Male holotype.—Color brown above and laterally, with the usual areolate buff maculae; cream below; legs cream except the tarsi, which are brown; antennae and vertex of head brown; ocelli dark, forming a triangular patch, arranged in rows of 1, 7, 6, 5, 4, 3, 2.

On the mesial surface of the first segment of the ninth legs there is a shallow depression and beyond it a sharp lobe (Fig. 14). The first segments of the tenth and eleventh legs, each with an apophysis near the opening of the coxal gland, are shown in Figs. 15 and 16. The sternal process at the base of the twelfth legs is distinctive in the slightly constricted base (Fig. 17).

The large ventral branch of each gonopod terminates in three processes, the lateral one sigmoid and darkly pigmented distally and the other two shorter and lanceolate; the dorsal branches are small and hamate (Fig. 19). *In situ* (Fig. 18) only the ventral branches are visible, their terminal processes outlined against the enlarged body of the branches.

Length about 17 mm.

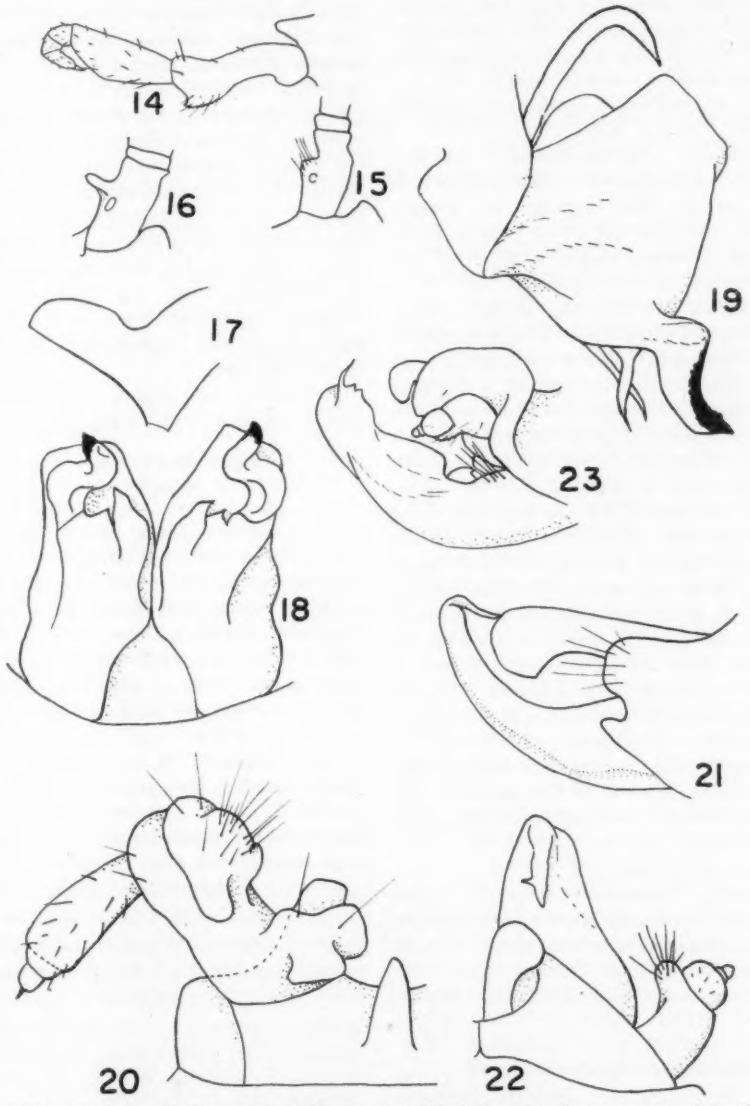
Type locality.—Illinois: Putnam County, Starved Rock State Park. The holotype, a female, and a larva were collected July 12, 1944, by Drs. T. H. Frison and M. W. Sanderson. One male, same collectors, August 14, 1944, White Pines State Park, Ogle County, Ill.

Ozarkogona, n. gen.

This genus resembles *Cleidogona* in body shape, absence of keels, smooth surface, shape of first segment, proportion of antennal segments, and in the structure of the gonopods, each of which consists of a hamate ventral branch and a shorter, clavate dorsal branch. The males are distinguished from *Cleidogona* by the absence of a medial sternal process at the base of the twelfth legs and by the ninth legs, which are 4-jointed and with a claw, the first joint enlarged as in *Bactropus*, the second cylindrical and without lobes, the third much shortened, and the fourth narrow but slightly longer than the third. It

differs from *Bactropus* in that the ninth legs are 4-jointed rather than 5-jointed and in the 2-branched gonopods. Gnathochilarium as in *Cleidogona*. Eyes triangular, composed of about 27 dark ocelli.

Genotype.—*Ozarkogona glebosa*, n. sp.



FIGS. 14–19.—*Cleidogona inflata*, male holotype: 14, Ninth leg; 15, first segment of tenth leg; 16, same, eleventh leg; 17, sternal process at base of twelfth legs; 18, gonopods *in situ*, 19, lateral view of left gonopod.

FIGS. 20–21.—*Ozarkogona glebosa*, male paratype: 20, Cephalic view of ninth leg and sternum; 21, lateral view of right gonopod.

FIGS. 22–23.—*Tiganogona moesta*, male paratype: 22, Caudal view of ninth leg and end of dorsal branch of gonopod; 23, lateral view of right gonopod and ninth leg.

Ozarkogona glebosa, n. sp.
Figs. 20, 21

Male holotype.—Color brown above, cream below; segmental setae set in small buff maculae; larger buff maculae arranged so that there appear to be a lateral buff band and a brown band below it; legs dark distally, cream proximally; antennae and vertex of head brown; ocelli dark, arranged in rows of 1, 7, 6, 5, 4, 3, 2.

The ninth legs (Fig. 20) consist of four segments; the fourth segment is short and ends in a short claw; the third is shorter but thicker; the second is thicker and about three times as long as the combined length of the third and fourth; the first is much enlarged, and on its cephalic surface are two large irregular lobes. The second and third segments appear almost coalesced, and midway of the first segment is an indistinct line that may indicate the coalescence of two segments. The third and fourth segments and the distal parts of the second are brown. A medial sternal process is anterior to the ninth legs, and posterior to them is a wide bifid plate. The gland openings on the first segments of the tenth and eleventh legs are but slightly raised; on the mesial surface, proximal end of the third segments of these legs is a low, cylindrical process.

In situ only the medial portion of the appressed ventral branches of the gonopods is visible. In lateral view (Fig. 21) each gonopod is seen to consist of a hamate ventral branch, the end sharp and directed laterad, and a shorter, thick, dorsal branch terminating in a club. *In situ* the dorsal branches pass between the sternal spine and the proximal lobes of the first segment of the ninth legs, while the ventral branches pass under the distal lobes.

Length about 16 mm.

Type locality.—Arkansas: Fayetteville; 5 males from north end of Mount Kessler, November 10, 1949. Other Arkansas collections have been made at Monte Ne, Benton County; Cane Hill, Washington County; and Clarksville, Johnston County.

Tiganogona Chamberlin, *emend.*

Tiganogona Chamberlin, Ent. News **39**: 154. 1928.

A recent examination of specimens of *T. brownae* Chamberlin, the genotype, from St. Charles, Mo., shows that the very small ninth legs were overlooked by Dr. Chamberlin, that he described the tenth legs as the ninth, the eleventh as the tenth, and that his reference to a protuberance on the second joint should be to the third joint. Accordingly, the following emendation must be made: Differing from *Cleidogona* in the ninth legs of the male, which are smaller, 5-jointed, and without a terminal claw; the first segment, the largest, is produced ventrally and may be embraced medially by the dorsal branch of the gonopod; the second segment is much reduced; the third is smaller than the second, and the fourth and fifth segments are minute. Each gonopod consists of two pieces, a dorsally curved ventral branch and a shorter and simpler dorsal branch. Although the ninth legs are minute as in *Ozarkogona*, these two genera are readily separated by the difference in the number of segments and the proportions of the segments of the ninth legs.

T. brownae is represented in the Illinois collection by one male from Burton, Ill.

Tiganogona moesta, n. sp.
Figs. 22, 23

Male holotype.—Color brown above, cream below; dorsal segmental setae set in small buff maculae; medial and lateral segmental setae set in larger, contiguous buff maculae which form a longitudinal band; a brown band is below the buff one; legs cream proximally, brown distally; antennae and vertex of head brown; coelli dark, forming a triangular patch, arranged in rows of 1, 7, 6, 5, 4, 3, 2.

The ninth legs are so small they could be overlooked, but they are made more conspicuous by the brown pigment on the distal three segments. The dorsal branches of the gonopods pass between the first segments and come to rest on the caudal surface; the lobe on the mesial surface of the second segment is almost as large as the globular third segment; segment four is minute; segment five is slightly larger and without a claw (Fig. 23). The first segments of the tenth and eleventh legs are slightly inflated and with the usual gland opening on the mesial surface; on the tenth legs there is a transverse ridge on the cephalic surface of the first segment and a rounded lobe on the proximal end of the mesial surface of the third segment.

The ventral branches of the gonopods are flattened dorso-ventrally distally and curved

gently upward and outward, so that *in situ* part of the dorsal branches and the first segments of the ninth legs are visible between them (Figs 22, 23). The shorter dorsal branches pass between the first segments of the ninth legs and their clavate ends rest on the caudal surface of these segments. Near their base, the ventral branches pass closely around a medial knoblike protuberance that appears to be a sternal process.

Length about 15 mm.

Type locality.—Arkansas: Carroll County, Blue Spring; two males, October 29, 1949. The species has been collected at Fayetteville, Washington County, also.

ICHTHYOLOGY.—*Additions to the known fish fauna of Mexico: Three species and one subspecies from Sonora.* ROBERT RUSH MILLER and HOWARD ELLIOTT WINN, Museum of Zoology, University of Michigan.

During an ichthyological survey of the Gila River Basin of Arizona, New Mexico, and northern Mexico, in the spring of 1950, the writers made the first fish collections to be recorded from the San Pedro River in Mexico. This stream, once a permanent tributary to Gila River, originates near Cananea in northern Sonora, where peaks of the Cananea Range rise to over 8,000 feet. The surrounding country is open and extremely dry, however, and 15 miles distant, at San Pedro Ranch, the average annual rainfall for the period 1935–1949, inclusive, was only 12 inches (data kindly supplied by Nicholas Sherbakov, San Pedro Ranch). Four collections were made along the main river and in two of its tributaries in the vicinity of San Pedro Ranch, which lies on Río San Pedro about 8 miles south of the international boundary line. The elevation of the ranch is approximately 4,500 feet.

On September 10, 1943, James R. Simon investigated San Bernardino Creek, about 18 miles east of Douglas, Ariz. This stream rises about 2 miles north of the international boundary line and then flows south into Sonora, Mexico, eventually to join Río Yaqui. About 1 mile below the border he took a catfish and a sunfish that constitute new records for Mexico. Neither species is native to the Republic west of the Continental Divide.

The following species are recorded for the first time from Mexico; the specimens are deposited in the University of Michigan Museum of Zoology:

Catostomus insignis Baird and Girard

The Gila coarse-scale sucker was fairly common just above the ranch of Don Rafael Elias, about 6 miles southwest of San Pedro Ranch, where 13 half-grown and 3 large adults (68–112 and 264–290 mm in standard length) were secured; only one half-grown (114 mm), seined at night, was taken above the large rock dam 2 to 3 miles west of Elias Ranch. Both localities are on a tributary to Río San Pedro, called locally Río San Rafael, which joins the main river about 4 miles upstream from San Pedro Ranch. The specimens were collected by the authors and Frances H. Miller on April 21–22, 1950. One large female extruded ripe eggs under slight pressure, indicating that spawning was imminent or in progress. The water was 73°F., the air 85°F. at 3 p. m.

Tiaroga cobitis Girard

The loach minnow was taken on April 22 in Río San Pedro, at its junction with Río San Rafael, about 4 miles south of San Pedro Ranch. Only 4 adults (37 to 48 mm long), from two rocky riffles, were secured. One riffle was about 25 feet long and formed three rivulets each 1 to 2 feet wide and about 2.5 inches deep. The other riffle, which lay at the head of an undercut pool, was about 8 feet long, up to 4 inches deep, and 2 to 3 feet wide. A long, shallow sandy stretch of approximately 140 feet lay between. The rocks were covered with a short growth of dense green algae and the river was entirely exposed to the bright sun. By using derris root, we obtained this meager sample of a species which undoubtedly was common in the Mexican portion of this river before its flow had become so drastically reduced.

Ameiurus melas (Rafinesque)

Black bullheads were abundant along Río San Rafael, just above the ranch of Don Rafael Elias and in the large reservoir 2 to 3 miles to

the west. From one pool 25 feet long, 3 to 12 feet wide and with a maximum depth of about 4½ feet, well over 125 catfish, mostly young, were caught and discarded. This pool was cut off by a gravel bar from the main stream, about 5 feet away, and was maintained by a spring seepage at its upper end. In the reservoir this species is much fished for by the natives. The largest specimen we took there weighed 16 ounces. *Ameiurus melas* evidently was introduced at an early date for local testimony indicated that these catfish were here in 1906.

The above material appears to represent the form currently called *A. m. melas* (Rafinesque), the northern black bullhead, for it typically has shorter spines, a heavier body, and perhaps fewer (18 to 21, usually 19 or 20) anal rays than the southwestern subspecies.

The southwestern black bullhead, *Ameiurus melas catulus* (Girard), was seined by J. R. Simon from San Bernardino Creek, 1 mile below the United States border, on September 10, 1943 (3 young to adult, 57–151 mm long). The same subspecies was caught on April 8, 1944, in a pond that lies ¼ mile below the border and a short distance west of San Bernardino Creek (5 adults, 119–209 mm long), by Marvin Frost and John Hendrickson. The anal ray counts of these 8 fish are 20(3), 21(3), and 22(2); the specimens with 20 rays have the elongate dorsal and pectoral spines that are believed to characterize this subspecies.

Two other species, which certainly once inhabited Río San Pedro in Mexico, were not seen by us although we did not work the drainage exhaustively. They may still survive in Mexico or, if not, they may return to this section of the river when (and if) more favorable water conditions prevail again; both species still occur north of the United States-Mexico boundary line in the Arizona portion of Río San Pedro. These two species are: *Pantosteus clarki* (Baird and Girard), the Gila mountain sucker, and *Meda fulgida* Girard, the scaleless spinedace.

Lepomis macrochirus purpurescens Cope

The southeastern bluegill is represented by 3 adults (102 to 105 mm long) taken by minnow seine in San Bernardino Creek, 1 mile south of the United States border, in water up to 4 feet deep. The broad and comparatively few vertical bars and the 12 anal rays of each specimen confirm the reference to this subspecies, which ranges from Florida north to North Carolina. A southwestern form, *Lepomis macrochirus speciosus* (Baird and Girard) is native to western Texas and tributaries of Río Grande in northeastern Mexico. In this subspecies, the modal number of anal rays is 10 and the dark bars are narrower and more numerous, as in *L. m. macrochirus*. Evidence that *purpurescens* is being (or has been) distributed was obtained by Carl L. Hubbs on June 22, 1938, when he visited the Federal hatchery at San Marcos, Tex. There he saw and obtained (U. M. M. Z. no. 120240) specimens of this subspecies, introduced four years earlier from the Federal hatchery at Lake Park, Ga., which was being reared and hatched at San Marcos for transplantation. In life the soft parts of the posterior fins, particularly the anal, are reddish on the half-grown. This fish, called locally "Georgia bluegill," was being stocked in preference to the native subspecies because it was said to grow faster and take artificial food better. Perhaps the San Marcos hatchery was the source for the sample taken in Sonora, Mexico.

Although we worked San Bernardino Creek from the international line to approximately 2 miles below the border, this species was neither seen nor collected by us on April 24, 1950. The creek was very low, however (almost completely dry in the United States), and the population of bluegills sampled by Simon either may have vanished or may now survive only in the lower portion of San Bernardino Creek where water was reported to be still abundant.

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